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MICRONUTRIENT DEFICIENCY INFORMATION SYSTEM

WORLD HEALTH ORGANIZATION

MDIS WORKING PAPER #2

GLOBAL PREVALENCE OF VITAMIN A DEFICIENCY




World Health Organization

United Nations Children's Fund

THE MICRONUTRIENT DEFICIENCY INFORMATION SYSTEM

The Micronutrient Deficiency Information System (MDIS) was established in 1991 in the Nutrition unit of the World Health Organization (WHO) in collaboration with the Community Systems Foundation of Ann Arbor, Michigan. The MDIS is a global surveillance mechanism for continually assessing the magnitude and distribution of deficiencies in three major micronutrients: iodine, vitamin A and iron. The databases provide the information required both to estimate the prevalence of these forms of micronutrient malnutrition on a national and global scale, and to provide timely and direct support for implementing and monitoring related prevention and control programmes.

Information is based on clinical indicators and selected biochemical and ecological parameters; it has been gathered from scientific journals, government documents, conference reports, and unpublished papers. To facilitate interpretation, every effort is made to specify the methods used in collecting and analysing information. Whenever possible, data are presented in tabular form stratified by administrative region, age, sex and nutrient status. On this basis, national "at-risk" and "affected" populations have been calculated. This degree of detail is provided in support of continuing efforts to standardize methodologies for assessing population-based deficiency rates. It is hoped that this will lead eventually both to improved monitoring of control activities and a better understanding of their impact within countries.

This is the second in the MDIS working paper series, available data on global prevalence of iodine deficiency disorders having been presented in 1993. A third report is in preparation, on the global prevalence of iron deficiency anaemia in children. Although previous efforts have been made to document the worldwide magnitude and distribution of micronutrient deficiencies, the MDIS is the most systematic and comprehensive approach developed thus far to providing robust epidemiological prevalence estimates of deficiencies of these three important micronutrients.

Because of the dynamic nature of global micronutrient malnutrition, WHO expects to update periodically this and other documents in the MDIS working paper series. Readers are urged to provide any missing information so that current estimates may be revised.

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Table of contents

Disaggregated data tables

References

Annexes

List of Tables

List of Abbreviations

ACC/SCN	United Nations Administrative Committee on Coordination/Subcommittee on Nutrition
AED	Academy for Educational Development
AMR	Region of the Americas
AFR	African Region
CIC	Conjunctival Impression Cytology
EMR	Eastern Mediterranean Region
EUR	European Region
FAO	Food and Agriculture Organization of the United Nations
HKI	Helen Keller International
HPLC	High Pressure Liquid Chromatography
ICN	International Conference on Nutrition
IDA	Iron deficiency anaemia
IDD	Iodine deficiency disorders
IEC	Information, education and communication
IVACG	International Vitamin A Consultative Group
MDIS	Micronutrient Deficiency Information System
MOH	Ministry of health
MSG	Monosodium glutamate
PEM	Protein-energy malnutrition
RDA	Recommended dietary allowance
RDR	Relative dose response
RE	Retinol equivalents
SC	Save the Children
SEAR	South-East Asia Region
TFNC	Tanzania Food and Nutrition Centre
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
VAD	Vitamin A deficiency
VAST	Vitamin A Supplementation Trials
VITAL	Vitamin A Field Support Project
WHO	World Health Organization
WHO/PAHO	World Health Organization/Pan American Health Organization
WPR	Western Pacific Region

PREFACE

Vitamin A deficiency (VAD), is the single most important cause of childhood blindness in developing countries. It also contributes significantly, even at subclinical levels, to morbidity and mortality from common childhood infections. Heightened awareness of the role of vitamin A in human health has led to an international effort to eliminate VAD and its consequences as a public health problem by the year 2000.

In 1987 WHO estimated that VAD was endemic in 39 countries based on the occurrence of clinical eye signs or symptoms, or very low blood levels of vitamin A (<0.35 μmol/l). This document updates this information based on biochemical evidence of subclinical VAD, i.e. population-based blood levels of vitamin A $\leq$0.70 μmol/l, supported by other biological indicators and such ecological risk factors as diet. It is now estimated that VAD, including clinical and subclinical forms of severe and moderate degrees of public health significance, exists in 60 countries, and it is likely to be a problem in at least an additional 13 countries. An estimated 2.8 to 3 million preschool-age children are clinically affected, and 251 million more are severely or moderately subclinically deficient. At least 254 million children of preschool age are thus "at risk" in terms of their health and survival.

VAD is the result of two primary factors. First, there is a persistent inadequate intake of vitamin A to satisfy physiological needs. This is frequently exacerbated by secondary dietary circumstances such as insufficient consumption of dietary fat, which leads to inefficient absorption of this micronutrient. The second factor causing VAD is a high frequency of infections. Infections depress appetite, prompting an elevation in the body's vitamin A utilization and consequently the nutrient's inefficient conservation. Other conditions related to poverty, e.g. social underdevelopment (particularly affecting women); inadequate environmental sanitation; and insufficient water supply for growing food, drinking and maintaining adequate personal hygiene are associated with malnutrition generally, often including VAD. These conditions of deprivation are reflected in high infant and child mortality rates, which may be reduced to a degree by improved vitamin A status. It is important, therefore, to identify populations with subclinical VAD, as well as those with xerophthalmia, to quantify the at-risk population and to implement intervention programmes that reflect the true magnitude and severity of the problem. Recent methodological developments and refinements in their interpretation permit this to be accomplished far more readily than in the past.

This document provides a comprehensive listing of data on the magnitude and distribution of VAD based on clinical and biochemical parameters that are supported by ecological risk factors. The intention is to provide an overview of the global distribution of VAD. However, in the absence of, in particular, nationally representative data from all countries concerned, national prevalence estimates have been made based on the best available representative sub-regional data. Estimates of the numbers of people "affected" and "at risk" are thus approximations subject to refinement as more representative and comprehensive data become available. Nevertheless, it is clear that there is a significant VAD problem in at least parts of most countries in Africa, South and South-East Asia, and some areas of Latin America and the Western Pacific. Generally speaking, VAD is not believed to be of public health significance in countries with established market economies; however, most of these countries have not recently conducted surveys that would detect subclinical deficiency if it were to occur among their less affluent populations. Thus far little information is available from the former socialist countries of central Europe.

This document is a first step in providing updated national estimates of VAD and in generating regional and global figures on this basis. The data serve as a baseline for tracking progress nationally and globally towards the virtual elimination of VAD, which is one of the end-of-decade micronutrient goals endorsed by the World Summit for Children (1990), the International Conference on Nutrition (1992), and the World Health Assembly (1993).

The document is divided into four sections. The first section describes the nature of VAD and reviews the epidemiological issues involved in measuring and interpreting VAD prevalence studies. It also describes in some detail the steps taken in extracting data from various sources. The second section presents summary tables of the most recent VAD prevalence data by country and WHO region. The third section presents more detailed sub-national prevalence data by WHO region and, where available, sub-national areas, thereby showing the geographic variability of VAD within countries. Biological data are presented with information concerning the specific laboratory procedures employed. The fourth section provides complete bibliographic information for all data sources presented in the national and sub-national prevalence tables.

INTRODUCTION & BACKGROUND

VITAMIN A DEFICIENCY (VAD)

Vitamin A is an essential nutrient needed in small amounts for the normal functioning of the visual system, growth and development, maintenance of epithelial cellular integrity, immune function, and reproduction. VAD occurs when body stores are depleted to the extent that physiological functions are impaired even though clinical eye signs may not be evident. Because the vitamin is fat-soluble it is stored in the body when intake is in excess of physiological need. Nearly 90% of that which is stored is found in the liver. Depletion of stored vitamin A occurs over time when the diet contains too little to replace the amount used by tissues or reduced by breast-feeding. The level of depletion at which physiological functions begin to be impaired is not entirely clear. What is known, however, is that the vitamin is actively recycled through the liver and among tissues, and it appears that rates of utilization by specific tissues can at least partially adapt to diminishing availability. This adaptation and recycling serves to maintain relatively constant blood levels until body stores become depleted below a critical point for which adaptation can no longer compensate *(1)*.

The integrity of epithelial barriers and the immune system are compromised before the visual system is impaired. This leads to increased severity of some infections and risk of death, especially among children *(2)*. When vitamin A depletion is sufficient to affect the visual system, nightblindness occurs first due to the body's decreased ability to generate rhodopsin, which is essential for vision in dim light. This is accompanied by a loss of goblet cells from the epithelial tissue of the eye and results in xerophthalmia ("dry eye") which can affect both the conjunctiva (conjunctival xerosis and Bitot's spot) and cornea (corneal xerosis), and may lead to corneal ulceration, invasion by microorganisms, and irreversible partial or total blindness (keratomalacia) *(3)*.

Ocular symptoms and signs resulting from VAD–xerophthalmia–have a long, well-recognized history, and have until recently been the basis for estimating the global burden from the disease. However, it is now recognized that the health of far larger numbers of preschool-age children *(4)*, and perhaps older children and pregnant or lactating women as well, is compromised by VAD, even at moderate, and possibly mild, sub-clinical levels.

Figure 1 illustrates the relation between age and basal requirements for vitamin A on the basis of body weight and recommended safe levels of intake. Required intake during pregnancy and lactation are included in Table 1. The estimated

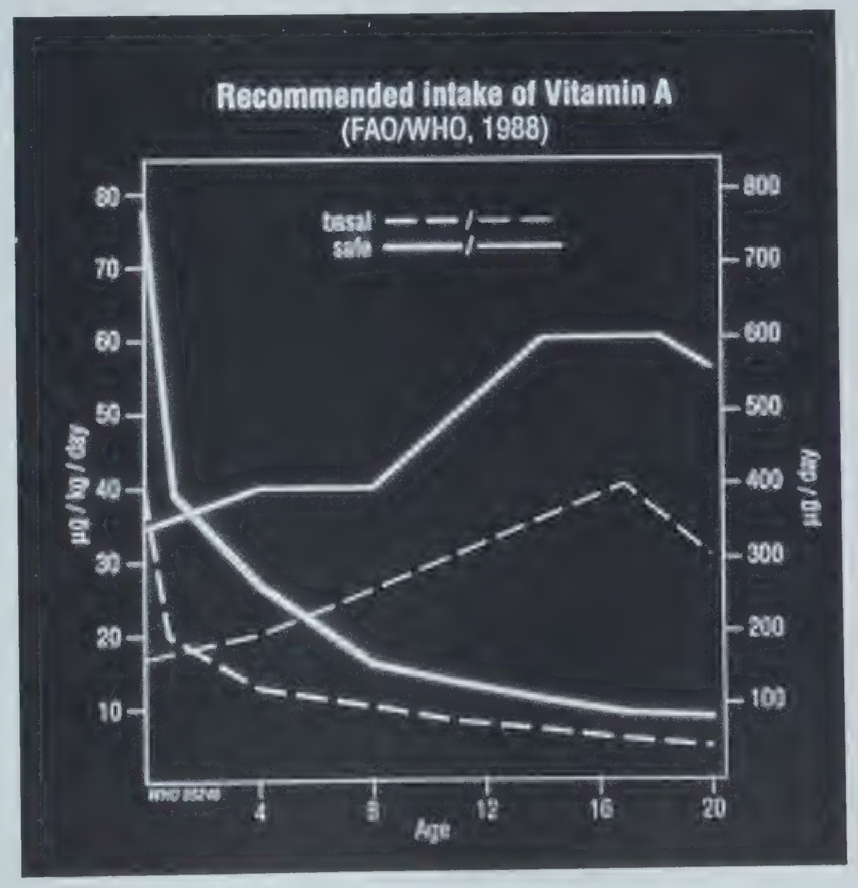
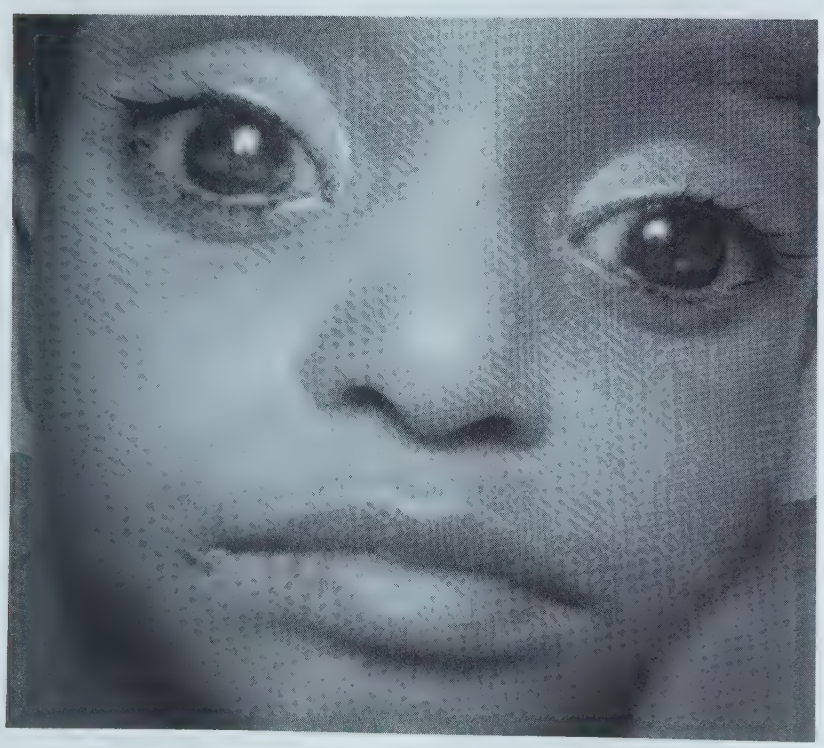


Fig.1 Estimated basal requirements for vitamin A by age

basal requirements and safe level of intake for vitamin A by age group and sex are also given in Table 1. When weighted by a typical age-sex distribution in a population, the basal vitamin A requirement for planning purposes is 250 μg daily and the recommended safe intake level is 550 μg.

Table 1. Estimated requirements for vitamin A (μg RE/day) *(5)*

Group	Age (years)	Basal requirement		Safe intake level	
		μg/day	μg/kg	μg/day	μg/kg
Both sexes	0-1	180	40-20	350	78-39
	1-6	200	13	400	26
	6-10	250	10	400	16
	10-12	300	8.3	500	14
	12-15	350	7.8	600	12
Girls	15-18	330	6.1	500	9.3
Women	18+	270	4.8	500	9.3
Pregnant women		370		600	
Lactating women		450		850	
Boys	15-18	400	6.1	600	9.3
Men	18+	300	4.8	600	9.3



Vitamin A deficiency before, and 4 days after, receiving a single high-dose (200 000 IU) of vitamin A.
Photo: B. Underwood

A 1989 estimation of the global supply of vitamin A is summarized in Table 2 according to WHO and UNICEF regions *(6)*. In recent years a slight increase in total supply has occurred in all regions of the world except in parts of Africa where supplies, apart from North Africa, have remained unchanged or declined. The increase has occurred mainly in vegetable rather than animal sources of vitamin A with the exception of China where per capita intakes from animal sources have increased. Although the available global vitamin A per capita is above basal requirements, safe levels of intake are not met in South and South-East Asia, or in East and Southern Africa.

Per capita availability data must be viewed with caution. For example, the highest per capita availability of vitamin A-activity in foods is found in the Sahelian belt and West Africa, most of which is from vegetable sources of provitamin A. In these African regions, clinical VAD is endemic just as it is in South Asia where the available per capita supply, also largely from vegetable sources, is two-fifths as great. Clearly per capita data can

Some vegetable sources of vitamin A.
Photo: B. Underwood

Table 2. Available supply of vitamin A by WHO region (μg RE/day)[a]

Region	Total	Animal	Vegetable
AFR	776	122	654
AMR	814	295	519
SEAR	431	53	378
EUR	738	271	467
EMR	936	345	591
WPR	997	216	781

Available supply of vitamin A by UNICEF region (μg RE/day)[a]

Region	Total	Animal	Vegetable
Eastern & Southern Africa	453	137	316
Central & West Africa	1035	105	926
Middle East & North Africa	951	336	615
East Asia & the Pacific	850	168	682
Americas & the Caribbean	814	295	519
Devl./Indus. countries	NA	NA	NA
South Asia	435	71	364

[a] Source: ACC/SCN

Table 3. Type of data available by WHO region

Region	Number of countries	No data or data prior to 1980	Data since 1980	National sample	Sub-national sample
AFR	46	19	27	7	20
AMR	36	22	14	1	13
SEAR	11	3	8	4	4
EUR	50	47	3	0	3
EMR	22	13	9	2	7
WPR	26	14	12	4	8

mask problems of uneven distribution. Hence, VAD continues to be a widely spread problem among preschool-age children even if recent information suggests that a decline is occurring in its most serious clinical form, keratomalacia *(7)*.

Country data presented in this document are not all based on representative national sampling. A listing of the type of data available by region and used to derive the summary tables is given in Table 3. A country-by-country evaluation of the available data is provided in the notes for each country to assist readers in interpreting the prevalence data. In several countries, current information is not available and judgements were made based on projections as to how recent events would likely influence earlier prevalence data. Attention is drawn to the fact that data are not available or current for a large number of countries in those regions where VAD is widespread. Thus, the estimates in Table 4 reflect only available data and should not be interpreted as the total population "at risk" either regionally or globally. Based on the available data projected to reflect conditions in 1994, the global estimates of the numbers of children 0-4 years of age clinically affected is 2.8 million, and severely and moderately subclinically affected (taken as one category), is 251 million. These estimates are provided by country in the summary tables and are summarized by WHO region in Table 4.

Table 4. Estimates of affected and at-risk populations[a]

Region	Clinical ($x10^6$)	Subclinical severe & moderate ($x10^6$)	Prevalence (%)
AFR	1.04	52	49.0
AMR	0.06	16	20.0
SEAR	1.45	125	69.0
EUR	NA	NA	NA
EMR	0.12	16	22.0
WPR	0.13	42	27.0
Sub -Totals	2.80	251	
TOTAL	254		

[a] Based only on a projection for 1994 from those countries in each region where data were available. See Table 3 for numbers of countries without data.

Epidemiology of VAD

VAD as a public health problem occurs within an ambience of ecological, economical and social deprivations in the macro-environment in which populations are found (i.e. regions and countries), and in the micro-environments in which families live (i.e. communities and households). The rela-

tive influence of causal factors at both the macro- and micro-level will vary among countries, and even regions within countries, necessitating a situational analysis to understand and subsequently design appropriate and effective intervention programmes to change specific undesirable situations. It is, therefore, with considerable reservation that national and global projections are made that could be inappropriately applied to local situations. Nevertheless, there are some underlying epidemiological traits that tend to characterize most situations where VAD occurs as a public health problem *(8)*. These are described below.

Ecological factors

At the macro-level, hostile environments, e.g. arid, infertile land, or the periodicity of excessive rain and humidity, in part determine the variety and amount of foods rich in vitamin A-activity that can be grown, and the duration of their availability. This applies particularly to vegetables (e.g. green leafy vegetables), and fruits that require abundant water supplies and/or moderate temperature to grow. Where the necessary favourable growing conditions occur in food-scarce countries, even if only seasonally, national agricultural policies generally favour production of staples as food for local populations. From a national perspective, vegetable and fruit crops are of less importance and thus do not compete for land use. Crops rich in vitamin A-activity for local consumption, therefore, are more often provided through horticultural activities at the micro-level. Even at community and household levels, however, the characteristics of a hostile environment, particularly where water is in short supply, limit home and community gardening activities and, as a consequence, the availability of inexpensive sources of vitamin A. Thus, countries or parts of countries with long periods of water shortage and relatively constant hot temperatures are more likely to have a VAD problem than those with stable water supplies.

The seasonality of VAD is only partially related to ecologic factors that influence food availability. The pattern of disease frequency is also important. VAD tends to reach its apex following the peak prevalence of diarrhoeal and respiratory diseases. Overcrowded housing and contaminated environments associated with poor living conditions contribute to the problem. Measles epidemics that occur under these conditions are especially devastating and often precipitate VAD, frequently resulting in blindness and death for many children.

Social factors

Social underdevelopment within a country limits accessibility to health and social services, including education. Under-educated, impoverished women tend to follow traditional ideas and practices, and are less confident in engaging in social interactions where more modern concepts and practices are promoted. Due to under-education, they are less likely to learn from educational materials typically displayed at health centres and used in health-related community educational activities, including those concerned with appropriate child care and feeding practices. Under-educated males also are less likely to adopt within their households new ideas and practices related to family care and feeding. A socially backward, impoverished environment also favours large families with consequent overcrowding that is associated with poor environmental sanitation and personal hygiene. As noted above, these are prime conditioning factors for VAD and malnutrition.

Economic factors

Poverty is a root, though not invariable, cause of VAD in public health terms. Because only foods of animal origin contain preformed sources of vitamin A, which are generally relatively expensive, VAD is confined largely to impoverished

countries, neighbourhoods and families which rely on less expensive provitamin A sources to meet their requirements. Provitamin A sources must be converted to retinol before they can provide protection from VAD. The series of events between consumption of provitamin A and its conversion to retinol include several steps that are dependent on normal physiological functions. For reasons discussed below under *Host factors*, it is more difficult to satisfy vitamin A-activity needs of infants and young children from foods of vegetable origin than from other food sources.

Poverty contributes in other ways, some already noted, to inadequate living conditions that are associated with high death rates among infants and young children. Unemployment and low-wage jobs are major obstacles to overcoming VAD in depressed environments.

Clustering

As already mentioned, the occurrence of clinical VAD tends to cluster rather than to be evenly distributed. Clustering within countries at the macro-level is related to ecological factors noted above exacerbated by poorly developed infrastructures to distribute vitamin A-containing foods from excess-to deficient-areas. Because vitamin A-rich foods tend to be quite perishable, they are especially susceptible to inadequate intra-country distribution.

Clustering has been described primarily based on the occurrence of clinical eye signs. It is likely to reflect the convergence of several risk factors that lead to depletion of vitamin A stores in the surrounding child population among which a few individuals who have been exposed to additional causal factors have developed clinical deficiency. For this reason severely subclinically deficient populations of children up to 5 years of age, based on the distribution of serum retinol levels, are considered to be as much at risk of severe morbidity and mortality as those populations experiencing clinical deficiency. Moderately subclinically affected populations are also likely to be at higher risk but the magnitude of risk is unknown.

Host factors

Age. Varying levels of VAD can occur at any age, from subclinical effects that increase risk of morbidity and mortality to blinding malnutrition (keratomalacia). As a public health problem, however, VAD affects children of preschool age because of their great susceptibility to infections and due to an increased demand for the micronutrient by the body to support their rapid growth. The potentially blinding corneal disease is most prevalent among children under 3 years of age and is usually associated with PEM. An increased risk of death of at least 60% is associated with severe, potentially blinding VAD malnutrition *(9)*. The mortality risk associated with VAD of lesser severity extends at least from 6 months to 5 years of age, and perhaps beyond. The elevated risk of death among those less severely clinically affected, and severe to moderately subclinically affected, is estimated to be about 23% *(4)*.

There is little information regarding the health consequences of VAD among school-age children. The prevalence of mild xerophthalmia, notably Bitot's spots, may be highest in the school-age group, although this may be more a reflection of past rather than current vitamin A status *(10)*.

Sex. No consistent sex difference in vulnerability is demonstrated based on physiological parameters. Differences have been reported from some cultures, which are more likely to be related to sex differences in cultural practices of feeding and care rather than to physiological differences.

Feeding practices. Breast milk provides retinol in a readily absorbable form. Clinically apparent VAD is rare among populations where breast-feeding prevails. Even though clinical deficiency rarely occurs as long as a child is receiving breast milk, depletion of an infant's body stores, leading to subclinical deficiency and consequent health risks, may occur by six months of age when maternal vitamin A status is inadequate and thus, breast milk vitamin A content is low *(11)*. In general, the problem of subclinical depletion increases in significance between 6 months and 3 years of age during which complementary foods and later the family diet, represents a large proportion of the infants diet. These foods often do not contain vitamin A in amounts that adequately replace that provided from the diminishing contribution of breast milk. The diet of the newly weaned child frequently has very little vitamin A and often contains less fat than at any other period in the life cycle. Dietary fat is especially important for the absorption of vegetable sources of provitamin A. The post-weaning period, until a child has begun receiving a diversified family diet, is therefore one of great vulnerability to VAD.

Disease patterns. The frequency, duration and severity of infections contribute directly and indirectly to vulnerability. Infections influence appetite and are especially devastating for the weaned child. Infections lessen efficiency of absorption, conservation and utilization of vitamin A. Frequent acute bacterial infections damage mucosal surfaces required for absorption. Furthermore, intestinal worm infections may directly compete for uptake of vitamin A in addition to their more general impact on health by suppressing appetite. The frequency of diarrhoeal and respiratory infections is associated with VAD vulnerability *(12)*. For diarrhoeal disease, restoring vitamin A status decreases the severity of subsequent episodes and the risk of death *(13)*. Curiously, no such link has yet been established with respiratory illness, except for pneumonia associated with measles *(14)*.

Breast-feeding reduces the risk of VAD.
Photo: B. Underwood

Periods of increased physiological need. Vitamin A needs on a body-weight basis are increased during periods of rapid growth (see Table 1 and Fig. 1), which is one reason for the greater vulnerability of younger children. School-age children are growing but at a slower rate than at earlier ages, at least until adolescence. In areas where VAD is endemic, however, the prevalence of Bitot's spots in schoolchildren is often above that seen in younger age groups, and may not in

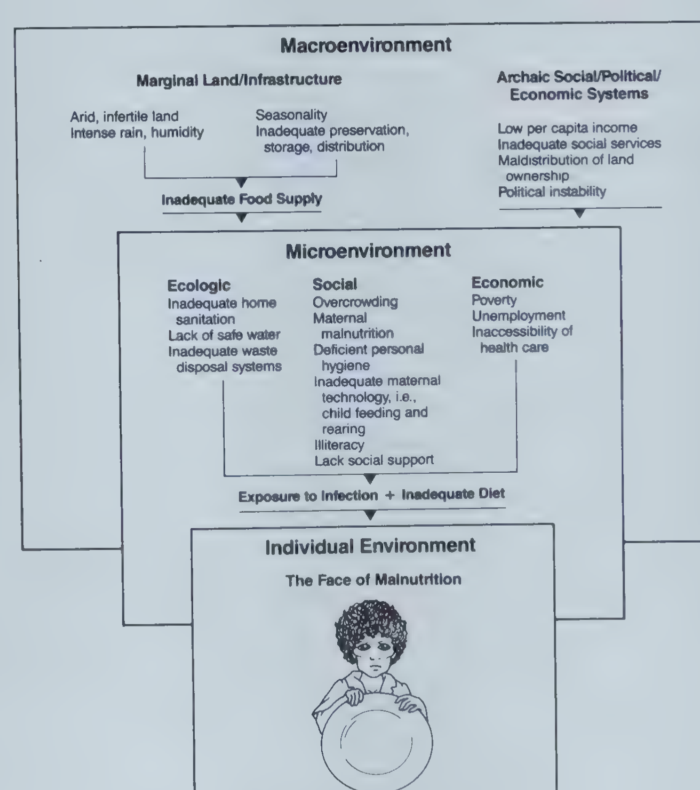


Fig. 3 The trap of deprivation

fact be responsive to improved vitamin A status *(15)*. There is only limited information to determine if increased morbidity or mortality risks are associated with Bitot's spots in school-age children.

Other periods of increased physiological need are gestation and lactation. Women are vulnerable to VAD in these periods because of the increased need to provide for the developing fetus and, following parturition, to replace vitamin A transferred from maternal stores via breast milk to the nursing infant. Pregnant and lactating women in underprivileged populations often report night blindness and studies have found that their breast milk frequently is low in vitamin A (breast milk vitamin A content reflects that of maternal diet and maternal vitamin A status) *(11,16)*. Few data are available to determine if there is an increase in morbidity or mortality risk to the mother that is associated with mild depletion of vitamin A stores. For this reason, pregnant and lactating women are not included in the global estimates of the at-risk population. This will be corrected as the MDIS databank receives more specific information about the vitamin A status of pregnant and lactating women, e.g. data on breast milk vitamin A levels.

INDICATORS OF VAD

Clinical eye signs are rare events. Therefore, when examinations are performed to determine prevalence of severe, potentially blinding VAD, large representative samples are required. Eye signs are, however, the most specific and sensitive of the VAD indicators. Biological indicators of subclinical VAD below selected cut-off points are more common, thus requiring a smaller sample size for estimating prevalence. Regrettably, however, all the subclinical indicators available to date lack specificity and/or sensitivity. Furthermore, when these indicators are used as the basis for cut-off points in determining the severity of vitamin A deficiency, additional population-based validation is required.

Clinical indicators

There is a standard classification system for ocular indicators of VAD, and minimum prevalence criteria for interpretation to identify a public health problem have been widely accepted and applied (Table 5). These criteria have been used to identify countries in the database with a significant public health problem of xerophthalmia and hence risk of VAD-related blindness.

Serum retinol

Distribution curves for serum or plasma retinol levels are useful for identifying populations likely to be at risk of VAD. The prevalence of values below selected cut-off points is useful for estimating the relative risk and prevalence of severity and its magnitude as a subclinical problem. A prevalence of values ≤ 0.35 μmol/l above 5% has been used globally to define a deficient population as corroborative evidence of clinical eye signs for risk of blinding malnutrition. However, this cut-off is insufficient to identify the prevalence of risk to those likely to have inadequate vitamin A status, i.e. who are subclinically deficient and suffering health consequences. For this purpose, <0.70 μmol/l was suggested earlier as a cut-off for inadequate vitamin A status, but the prevalence criteria to define a public health problem was not generally applied except in the Latin America and Caribbean region (AMR). In the Region of the Americas a prevalence of $>15\%$ below 0.70μmol/l has been generally applied to identify an unacceptable situation *(18)*. New evidence substantiating increased mortality risk among populations without clinical signs has necessitated a reevaluation of cut-off points and criteria for interpreting serum retinol distributions. A WHO consultation *(19)* held to address this question recommend that

Table 5. Classification of xerophthalmia and prevalence criteria constituting a public health problem *(17)*

Criteria[a]	Minimum prevalence
Night blindness (XN)	>1.0%
Bitot's spot (X1B)	>0.5%
Corneal xerosis and/or ulceration (X2,X3A,X3B)	>0.01%
Xerophthalmia-related corneal scars (XS)	>0.05%
(A serum retinol level <0.35μmol/l in >5% of the population is corroborative evidence)	

[a] See reference 3 for detailed definitions and illustrations of the clinical classification and diagnosis of xerophthalmia.

a cut-off level of ≤0.70 μmol/l be used and that the prevalence of values below the cut-off be ranked to indicate the degree of public health importance as shown in Table 6. The consultation recommended that a severe public health problem be defined as existing when 20% or more of a surveyed preschool-age child population has values ≤0.70 μmol/l, and a minimum prevalence of ≥10% to identify a moderately severe public health problem. It was also recognized that among well-nourished, healthy populations of preschool-age children, and even those still living in poverty but whose vitamin A status is adequate, fewer than 5% have values ≤0.70 μmol/l *(20)*. Therefore, a category is included to identify a mild problem worthy of consideration even when the prevalence is <10% of the surveyed preschool-age population having serum levels ≤0.70 μmol/l.

Unilateral blindness before 6 months of age due to vitamin A deficiency in a non-breast-fed Thai child given an unfortified condensed milk product. Photo: E. Wasanwisut

Table 6. Prevalence of VAD in children ≥ 1 year of age of serum values ≤ 0.70 μmol/l

Level of public health problem	Prevalence
Mild	≥2 -<10%
Moderate	≥10-<20%
Severe	≥ 20%

The prevalences in Table 6 for severe and moderate subclinical VAD have been used in this document to classify countries and to estimate the at-risk population. The "mild" category was not included in calculating the at-risk estimates. These prevalences need further verification under field conditions using other indicators of VAD. Several factors common to deprived populations can lower serum values of vitamin A or status independently of intake, e.g. acute and chronic infections *(21)*. The variable prevalence of these confounders among populations may in future necessitate using different criteria for different situations.

Young girl with xerophthalmia consuming a low-vitamin A meal. Photo: International Center for Eye Health, London

Other biological indicators

As noted above, additional supporting evidence is needed because no single biological indicator of subclinical VAD by itself, is of sufficient specificity and sensitivity to identify a public health problem. Other indicators of subclinical VAD include dose response tests and CIC. These measures of VAD also have limitations both due to confounders and in terms of reliability of interpretation. In addition, they have had very limited application in field surveys. Data using these indicators are entered into the database as they accumulate. However, data collected on the basis of these new assessment techniques, have not been included here for determining prevalence of at-risk populations. They are used only as corroborative information. The prevalence of VAD can be determined only by using biological indicators. Once again, the root cause of VAD in a public health context is habitual inadequate dietary intake of foods containing vitamin A-activity, i.e. pre-formed vitamin A and provitamin carotenoids. Reliable quantitative assessment of habitual dietary intake is problematic, however. Newer approaches to solving this problem use qualitative or semi-quantitative measures of intake frequency of vitamin A-containing foods. The information obtained is useful in corroborating biological indicators, which is how it has been used in this document.

A fuller discussion of the use of other nutritional, ecological and demographic indicators for surveillance purposes other than determining prevalence is presented in a separate WHO document.[1]

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[1] *Indicators for assessing vitamin A deficiency and their application in monitoring and evaluating intervention programmes document*, WHO/NUT/94.1, available from the Nutrition unit, WHO, Geneva.

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MDIS

GLOBAL PREVALENCE OF VITAMIN A DEFICIENCY

TABLES SUMMARIZING VITAMIN A DEFICIENCY PREVALENCE BY COUNTRY IN EACH WHO REGION

INTERPRETING DATA IN THE MDIS

To ensure their proper interpretation there are several considerations which must be borne in mind in the present analysis and presentation of VAD prevalence data. Although efforts have been made to standardize methodologies employed in the design and implementation of VAD prevalence surveys, there is in fact considerable variation in the way these surveys were conducted and how results were analysed. This means lack of comparability across studies.

Survey design

Depending upon the objectives for VAD surveillance, distinctly different approaches have been used in the design of surveys and the selection of samples to ensure the greatest degree of representativeness. For cross-sectional surveys, when data are collected at a single point, it is generally appropriate to use stratified sampling techniques with sample sites being selected to provide a representative impression of a population, using either random, cluster or PPS (population proportional to size) techniques. Since clinical VAD is rare, even in areas where there is a significant public health problem, i.e. 1 case of corneal xerophthalmia seen in 1000 children (X2 = .01%) the sample size requirements for clinical surveys must be quite substantial to ensure reliability. It is crucial, therefore, that sample size calculations be considered when reviewing data and when ascertaining the precision of individual survey estimates. Furthermore, since in most developing countries, VAD tends to occur only in a small number of communities (clustered) rather than being equally distributed throughout populations (homogenous) specific survey sampling designs are required so that variance estimates are not miscalculated and confidence intervals misrepresented.

A survey methodology influences the interpretation of results in terms of their representativeness and statistical precision, and different methodologies make inter-country comparisons difficult. The MDIS has attempted to deal with this problem by cataloguing the sampling methods used in each survey, including the design, selection of sites, selection of individuals, and the sample size. However, many documents which summarize information from VAD prevalence surveys do not provide complete information on the study methodology.

Subject selection

The MDIS has also included information on subject characteristics: sex, age, and sub-national residence. This information is particularly important for comparing prevalence estimates across studies. There are important differences in the prevalence of VAD in various age groups, and so direct comparisons are difficult. It is imperative to detail this information when presenting VAD prevalence data.

Data aggregation

For purposes of global advocacy, an understanding of the national magnitude of VAD is required. However, the aggregation of data to derive a single national estimate limits the ability to highlight the important differences that may exist in the distribution of VAD within countries. In the MDIS, data are maintained for sub-national areas, so that the intra-country disparities in VAD may be seen, and populations at greatest risk recognized.

Limitations

The data presented in this document are the most up-to-date vitamin A prevalence information available to the MDIS based on an extensive literature review and reports available to WHO and other organizations. These estimates will be revised periodically as more data become available. It is recognized that some reports may have been missed because they were not published,

or otherwise unavailable to WHO. One of the prime objectives of this document is to identify and fill remaining gaps in the global database, and to gain access to supplementary information that will ensure that subsequent revisions are complete.

Surveys from small areas may provide a biased prevalence estimate, especially if they are performed in areas known to have a high prevalence of VAD, and may not represent the entire country. The present document makes no claims about the accuracy of laboratory procedures performed in the surveys, the comparability of the cross-survey assessments, or the methods employed in each survey. For more details about the characteristics of individual surveys, the reader is directed to original documents as specified in the *Bibliographic references* section. These references are on file as part of the MDIS database in the WHO Nutrition unit.

GUIDE TO USING SUMMARY TABLES

Each country where a problem of VAD is documented or suspected is listed by WHO region. Where data are based on surveys prior to 1980, judgement is used in determining how recent developments may have altered the situation. An "X" designates the estimated category of deficiency, i.e. clinical, severe subclinical or moderate subclinical where survey data are not available but current reports indicate there is a problem. When a rate is derived from more than one survey, a superscript E is inserted by the number. Where known, the year of the survey on which the prevalence is based is given. The national population figure is the UN projection for 1995 of the 0-4-year-age group. Prevalence values in the table are therefore for preschool-age children only.

Criteria used to define the severity of a public health problem are as follows:

Clinical. The number in the table refers to the prevalence of total xerophthalmia, or of other clinical eye signs, i.e. Bitot's spot (X1B), corneal xerosis (X2), keratomalacia (X3) and corneal scars (XS) and/or symptoms, i.e. nightblindness (XN) measured. Values are included only if they exceed the level defined by WHO as constituting a public health problem as defined in Table 5. Where clinical data are documented the population clinically affected is noted (in thousands) in parentheses directly below the prevalence (%).

Severe subclinical VAD. A prevalence of ≥20% with blood values ≤0.70 μmol/l (with or without clinical eye signs or symptoms) as shown in Table 6.

Moderate subclinical. A prevalence of ≥10-<20% with blood values ≤0.70 μmol/l (with or without clinical eye signs or symptoms) as shown in Table 6.

A multiplication factor was derived for countries where representative national surveys of vitamin A deficiency were unavailable. Where sub-national surveys were available, extrapolations were made to the proportion of the total country likely to be affected considering similar ecological conditions. From this a multiplication factor was generated as shown in Table 7:

Table 7. Method for determining at-risk population

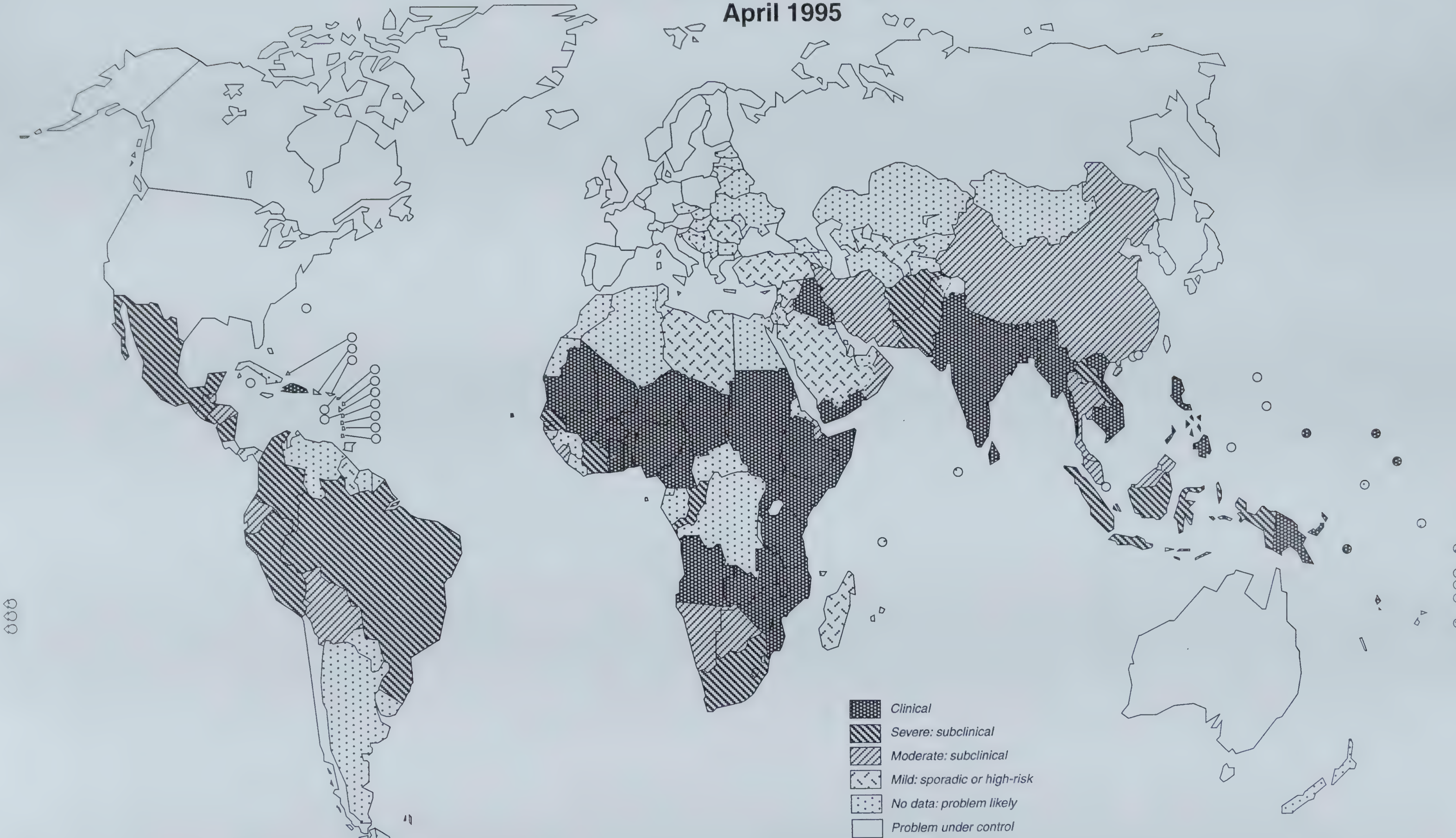
Estimated portion of country affected	Multiplication factor
National sample	0.75
>60-<75%	0.60
>30-<60%	0.40
>20-<30%	0.25

The at-risk population was estimated as follows. The multiplication factor was applied in countries in which WHO criteria to identify a public health

problem of VAD clinically or subclinically were met. The total population of children 0-4 years of age according to the UN projection for 1995 multiplied by the factor determined the total, i.e. clinically + subclinically, at-risk population. In countries with clinical VAD, the prevalence of clinical signs was multiplied by the total at-risk population to estimate the number of children clinically affected. That number is given in parenthesis under the clinical prevalence figure. In countries with no clinical problem but a severe subclinical one, the at-risk population estimate includes those who also are moderately subclinically deficient.

Countries categorized by degree of public health importance of vitamin A deficiency

April 1995

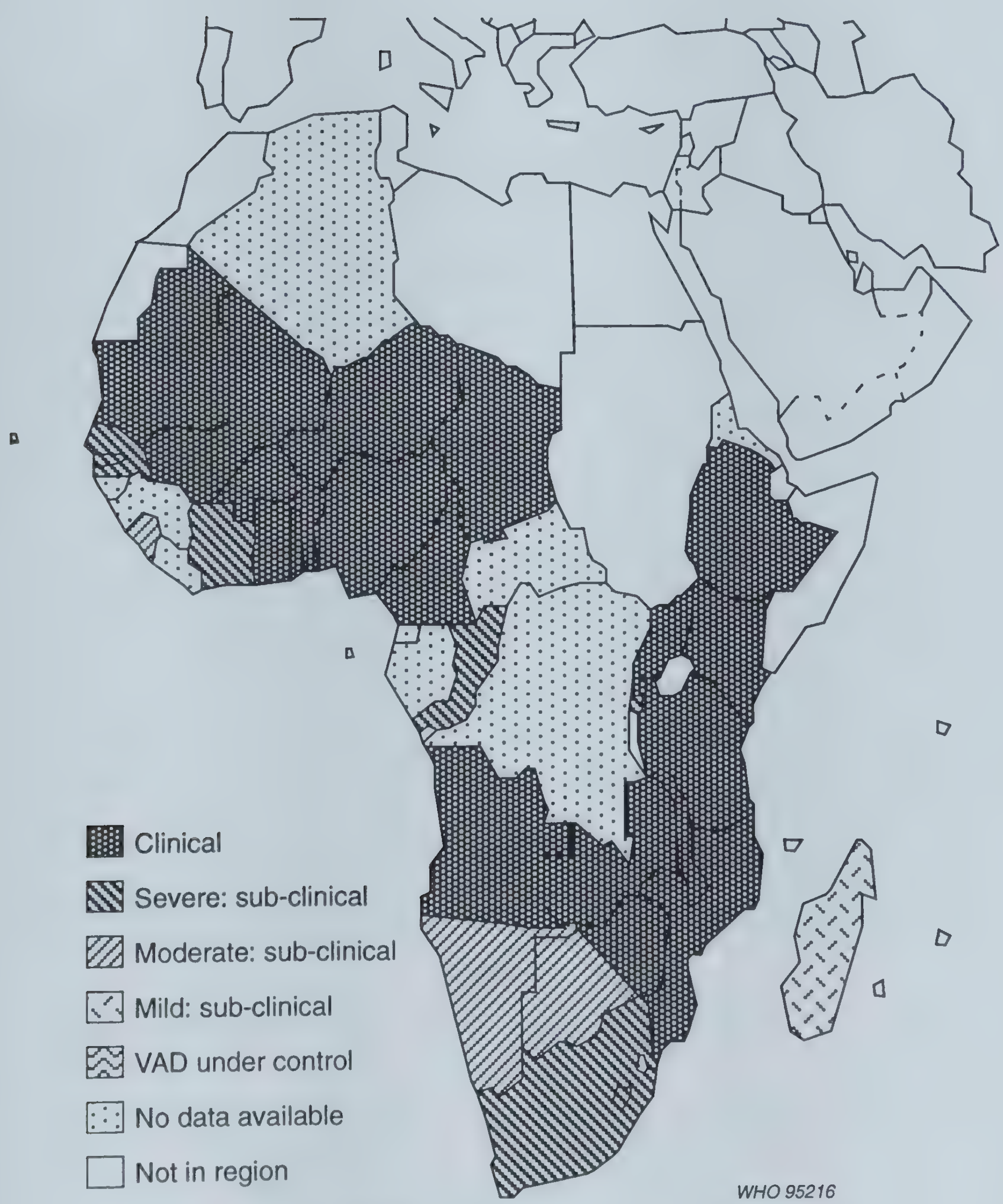


The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines represent approximate border lines for which there may not yet be full agreement.

Prevalence of Vitamin A Deficiency

African Region

April 1995



The designations do not necessarily imply VAD severity is uniformly distributed throughout each country

Summary of Vitamin A Deficiency Prevalence Data - African Region

Country	Year	Population * (000)	Prevalence*: Clinical	Prevalence*: Severe sub-clinical	Prevalence*: Moderate sub-clinical	Multiplication factor*	Population at risk* (000)	Notes
Algeria		4260					?	No data available. VAD likely.
Angola	1973	2195	3.0 (26.3)		X	0.40	878	No recent data available. Survey in Bie Province (1973) found a X1B prevalence of 3%. VAD currently suspected to be a problem as a result of malnutrition brought on by war, drought and massive migration. Further assessment needed.
Benin	1989	1061	8.3[E] (52.8)			0.60	636	No national data. VAD considered a problem in clustered areas in the northern sections of the country. A study in North Atacora (1989) found a XN rate of 3.4% and a X1B rate of 4.9%. Older data available on an unidentified age group in 3 districts of Atacora (1975) found a high xerophthalmia rate of 3.35%. No biochemical data are available, though clinical data suggest that VAD is a public health problem. Vitamin A capsules are being distributed by UNICEF. Further assessment needed.
Botswana	1992	238			X	0.25	59	ICN report (1992) shows evidence of mild-to-moderate vitamin A deficiency. A nutritional survey (1971) of 77 255 people in 3 villages recorded very few clinical signs of deficiency.
Burkina Faso	1986–89 1978	1899	1.7 - 3.3 (28.2)	70.5		0.60	1139	No national data. Sub-national survey (1986) of three Northern provinces of the country (Yatenga, Passore and Sourou) found a X1B rate of 0.27%, a XN of 2.82% and a total xerophthalmia rate of 3.27% in children 0–5 years of age. A survey of six provinces (1989) found a XN rate of 1.42% and a X1B rate of 0.26% among children aged 2–10 years. A dietary survey (1984) found low intakes of fruits while an older survey (1978) observed high level of marginal VAD, with 70.5% of preschool children having serum retinol levels <0.70 µmol/l and an overall mean of only 0.58(± 0.23) µmol/l. HKI, UNICEF and MOH distributed vitamin A capsules in four northern provinces between 1986 and 1989
Burundi		1183		X		0.40	473	No data available. VAD highly likely in parts of country due to recent civil unrest and occurrence in surrounding countries.

* Refer to *Interpreting data in the MIDS* pg. 15

SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - AFRICAN REGION

Country	Year	Population * (000)	PREVALENCE* Clinical	Severe sub-clinical	Moderate sub-clinical	Multiplication factor*	Population at risk* (000)	Notes
Cameroon	1992	2270	0.5 (4.5)	19.7		0.40	908	No national data. Study in the Extreme North Province (1992) found a X1B prevalence of 0.47%, the highest prevalence found in the mountainous region and that 19.7% of children in periurban and flooded areas had serum retinol levels <0.70 µmol/l. A small study in Kale Department of the North Province (1988) found 50% of 3–12-month-old children with serum retinol levels <0.35 µmol/l.
Cape Verde		67		X		0.40	27	Though there are no data on children under 5 years of age, data from surveys of the general population in Fogo and San Vicente suggest high prevalence of VAD with X1B rates of 2.9% in females and 3.6% in males. However, these data are based on very small sample sizes and their precision is questionable. Biochemical data from the same study of children between 7–13 years of age noted 6.7% with serum retinol levels <0.35 µmol/l.
Central African Republic		621					?	No data available. VAD likely.
Chad	1986	1108	2.7 - 4.5 (29.9)			0.75	831	No national data. Data on 0–5-year-olds from Chari-Baguirme, Bath and Ouaddi (1986) in the Northern and Central areas of the country found clinical VAD levels extremely high with a total xerophthalmia rate of 2.7%. Though there is considerable variation between regions (rural areas of Chari-Baguirme reporting a rate of 4.5%), VAD is considered a public health problem in the country. No biochemical data are available.
Comoros		130					?	No data available.
Congo	1988	483		26.0[s]		0.25	121	No national data. Biochemical data collected from Brazzaville and Pointe Noire (1988) found low serum retinol levels among children, especially those with malaria (83.3% <0.70 µmol/l). The mean was 0.52 µmol/l.
Côte d'Ivoire	1994	2927		46.6		0.60	1756	Preliminary study in 4 departments in the northwest (1994) found serum retinol levels of <0.70 µmol/l in 46.6% of the infants surveyed after supplementation. A survey in 3 communes (1988) found that 25% of children aged 1–3 years had serum retinol levels <0.35 µmol/l.
Equatorial Guinea		70					?	No data available. VAD likely.

* Refer to *Interpreting data in the MIDS* pg. 15

SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - AFRICAN REGION

Country	Year	Population * (000)	PREVALENCE*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
Eritrea							?	No data available. Study planned for 1995.
Ethiopia	1980–81	9567	4.6 (330.1)	51.0		0.75	7175	National data (1980–81) from representative survey of preschool children aged 6 months–5 years indicated VAD to be a significant public health problem in all zones of the country except the Ensete zone, with a national X1B average of 1.0% and estimated total xerophthalmia rates of 6%. Large-scale study in Shoa region (1981) found X1B prevalence just above 0.5%. Biochemical data (1981) corroborated this finding with 59.6% of children 6–71 months of age having serum retinol levels <0.70 µmol/l and a mean of 0.62 µmol/l. VAD has also been found to be especially severe in refugee camps.
Gabon		231					?	No data available. VAD likely.
Gambia	1988	169		X		0.25	42	Data from surveys (1988) of children 2–6 years of age indicate that VAD is highly seasonal, occurring during the months of January–March and October–November. There was a large increase in mean serum retinol levels from 0.41 µmol/l in January to 0.78 µmol/l in August.
Ghana	1989–91	3049	1.1[£] (13.4)	54.9[£]		0.40	1220	Data from Kassena-Nankana (1989–91) indicate that VAD is a problem in the Northern and Upper East areas of the country. Over 14% of the preschool children who had serum samples taken had serum retinol levels <0.35 µmol/l and over 50% <0.70 µmol/l. A XN rate of 1.04% and a X1B rate of 0.01% was found. Morbidity Survey (1991) found an XN rate of 1.5% while the Survival Survey (1991) found 0.70%. Large-scale vitamin A supplementation trial has increased awareness of the VAD problem and has led to the establishment of a national VAD control program by MOH.
Guinea		1308					?	No data on children <5 years of age. Data on pregnant women (1980) show some problems of VAD with X1B rates as high as 5.2% in the north of the country. VAD is suspected also to affect children and the elderly.
Guinea-Bissau		179					?	No data available. VAD likely.

* Refer to *Interpreting data in the MIDS* pg. 15

Summary of Vitamin A Deficiency Prevalence Data - African Region

Country	Year	Population * (000)	Prevalence*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
Kenya	1976–81	5162	0.2-1.1 (13.4)			0.40	2065	National data (1976–81) on an unspecified age group showed low prevalences of VAD (0.26%) while regions in the Highland tribes of Baringo and pockets of arid and semi-arid zones (Marsabit, Mwea) indicated VAD to be of public health significance with X1B rates as high as 1.13%. Hypovitaminosis A is thought to be a problem among a large proportion of children.
Lesotho	1993	295	0.0	78.0		0.75	221	A nationally representative survey (1993) found no clinical signs among children 2–3 years of age and only a few signs of Bitot's spots in children aged 4–6 years. More than 78% of preschool children had serum retinol values <0.70 µmol/l and 13.4% <0.35 µmol/l. A mean of 0.6 µmol/l was recorded.
Liberia		570					?	Nutritional assessment (1990) of Guinean nationals and Liberian refugee children in Guinea showed no clinical signs of avitaminosis A. Mild VAD likely.
Madagascar		2598					?	Small survey conducted in 1992. Data not available. Mild problem likely.
Malawi	1983–89	2323	2.0[E] (27.9)			0.60	1394	Survey in the Lower Shire Valley (1983) revealed that VAD was of public health significance in this area with a total xerophthalmia rate of 3.0%. A study in Mbalachanda District (1988) found a prevalence of only 0.6% while a survey in Mkhota (1989) found a xerophthalmia rate of 1.7%. Old data analysis in the Lower Shire Valley (1970) found that 95% of the households had inadequate vitamin A intakes during the post rainy season. The health sector distributes vitamin A supplements to high-risk groups.

* Refer to *Interpreting data in the MIDS* pg. 15

SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - AFRICAN REGION

Country	Year	Population * (000)	PREVALENCE*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
Mali	1986 1978–79	2131	6.5[E] (103.9)	73.0[E]		0.75	1598	National data estimated from surveys done in most regions of the country. Data from 3 different populations in Tomboctou and Segou (1986) found all xerophthalmia rates to be above those indicative of posing a public health problem. Biochemical study (1990) conducted in NW Bamako noted that 15.1% of children 2–10 years of age had serum retinol levels <0.35 µmol/l. Biochemical data from Southern Mali (1978–79) indicated a high prevalence of subclinical VAD with over 12% of children 0–6 years of age having serum retinol values <0.35 µmol/l with a mean of 0.58(± 0.2) µmol/l. There are negligible differences in serum retinol levels between the rainy and dry seasons. In a survey of four populations (1986), each was found to have total xerophthalmia rates above 5% in children <5 years of age. A survey in Douen (1990) found a XN rate of 9.0%. In 1989 as part of a 5-year programme, vitamin A capsules were distributed to pregnant women and children under 5 years of age by HKI, USAID and AED.
Mauritania	1983 1987	428	2.6[E] (6.7)	41.6[E]		0.60	257	Study by USAID (1983) found xerophthalmia prevalences between 2.5% and 2.7%. More recent data from Nouakchott (1989-90) observed significantly lower clinical prevalence rates for children aged 7–10 years. Biochemical data from Hodh-El Gharbi (1987) showed a wide variation in serum retinol levels, with 2/3 of all children aged 1–15 years in Kerkerat having serum retinol values <0.70 µ mol/l but only 10% of children in Limberha falling below this cut-off point.
Mauritius		1130					?	No data available. Vitamin A deficiency not considered a public health problem.
Mozambique	1990	2943	0.7 (5.2)			0.25	736	No national data. Survey in 3 cities (1990) of 10 267 children aged 6 months to 6 years found a VAD prevalence of 0.7%. No biochemical data are available. Clinical information also available from a survey of 3790 displaced children of war in Zambezia Province (1987–88) where it was noted that 11% of all childhood blindness was due to keratomalacia, with estimated prevalences of XN=7.3%, X3B=0.25% and XS=0.89%.

* Refer to *Interpreting data in the MIDS* pg. 15

SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - AFRICAN REGION

Country	Year	Population * (000)	PREVALENCE*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
Namibia	1992	304			20.4	0.75	228	Biochemical data available from survey conducted in 17 villages from 4 regions (1991) which revealed that 20.4% of children 2–6 years of age had serum retinol levels below <0.70 μmol/l and 3.1% <0.35 μmol/l. However, there were quite dramatic differences in serum vitamin A levels between villages, with only 2 villages having any cases of severe subclinical VAD (serum retinol <0.35 μmol/l). It is noteworthy that the sample size for the survey was quite small.
Niger	1988	1820	2.0 (27.3)			0.75	1365	Survey data from Tahoua, Maradi and Zinder (1986) demonstrated a severe VAD problem with XN=4%, X1B=0.72% and corneal lesions of 14/1000 preschool children. National survey (1988) found a 2.0% prevalence rate for nightblindness. Data from several regions (1990) indicated that VAD is widely distributed, with XN >3% in Tera, Tillaberi and Ouallam Provinces. Dietary survey of 6–71-month-old children completed in 1994 in Tahoua and Maradi. Biochemical data (1970s) found the surveyed refugees to be severly vitamin A deficient.
Nigeria	1994	23 409	1.0 (175.6)			0.75	17 557	National survey (1994) found a XN rate of 1.0% among children <6 years of age. Biochemical data from the south found a serum mean of 0.72 μmol/l. Study (1977) noted that 4% of blindness in children was due to keratomalacia and a later study in Kaduna Eye Hospital (1979) claimed that 69% of all blind children had corneal ulceration. Biochemical data in Cross River State (early 1980s) showed a mean serum level of 1.1 μmol/l among children aged 0–1 years.
Rwanda	1987	1720	1.3 (13.4)	X		0.60	1032	No national data. Sub-national data from Gikongoro Prefecture (1987) revealed a X1B rate of 1.3% among children 0–6 years of age. National survey was scheduled for 1993. Due to deteriorating conditions, VAD likely to be a country-wide problem.
Sao Tome & Principe							?	No data available.

* Refer to *Interpreting data in the MIDS* pg. 15

SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - AFRICAN REGION

Country	Year	Population * (000)	PREVALENCE*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
Senegal	1988 1991	1454	0.0	71.5		0.60	872	No national data. Study in Malicounda (1990–91) found no signs of xerophthalmia in children 2–14 years of age. Survey in Gadiack and Diop N'doffene (1989) in April and June before and after the mango season found 40% and 11.4% <0.35 µmol/l, respectively. Data from Diourbel and Fatick (1988) indicated that 14.1% of the 1–6-year-olds presented signs of XN, although only marginal X1B rates noted. Biochemical results on children normal by ICT showed a mean of 0.45 µmol/l. Survey in Linguere (1991) showed a mean of 0.61 µmol/l (71.5% <0.70 µmol/l) and that 90% of the diets sampled contained less than 50% of the RDA of vitamin A.
Seychelles							?	No data available. No problem likely.
Sierra Leone		876			X		?	Vitamin A deficiency has not been reported in Sierra Leone. This may be due to the fact that oils (palm oil in particular) are widely consumed. However, it is likely that there is a moderate subclinical problem.
South Africa	1991	5838	0.0	49.0		0.25	1459	Survey done in Bester Farm (1991) found that 49% of those surveyd had serum retinol levels <0.70 µmol/l and 5% had levels <0.35 µmol/l. No clinical signs of VAD were found.
Swaziland		136					?	No data available. VAD likely.
Togo	1992	764	10.0 (45.8)			0.60	458	National survey (1992) indicates vitamin A is endemic in North Togo (Savanes and regions). Prefectures had XN rates of 10%. No biochemical data.
Uganda	1991	4139	3.0-4.0 (57.9)			0.40	1656	No national data. A survey in the Kamuli District (1991) found signs of xerophthalmia in 4% of 5074 children between the ages of 0–6 years. Of these, 2.7% of the cases were nightblindness (history), but 1% had X1B indicating a significant public health problem in at least the Northern and possibly Eastern districts of the country. Of those children <5 years of age, approximately 3% showed signs of xerophthalmia. There is a large percentage of children with inadequate dietary intakes resulting in a population where 1/3 of the children are at high risk and 1/5 at medium risk of VAD.

* Refer to *Interpreting data in the MIDS* pg. 15

SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - AFRICAN REGION

Country	Year	Population * (000)	PREVALENCE*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
United Republic of Tanzania	1984 1982–85	6036	1.5 (54.3)	45.3		0.60	3622	Large survey (1984) conducted in 8 provinces found a total xerophthalmia rate of 1.53% with VAD a problem of public health significance in Iringa province where the X1B rate was 1.6%. Data from Tabora region (1982-85) indicated that 0.6% of 3177 preschool-age children had X1B and 45.3% had serum levels <0.70 µ mol/l.
Zaire		8595					?	No data available. VAD likely.
Zambia	1988 1985	1790	1.4 (15.0)		16.5	0.60	1074	No national data. A large-scale VAD prevalence survey in Luapula Province (1985) of children <5 years of age found moderate levels of clinical xerophthalmia (XN=1.26%, X1B=0.44%, total xerophthalmia = 1.89%) but revealed indications of past VAD with a XS rate of 0.68%. The biochemical tests found 16.5% of those surveyed had serum retinol levels <0.35 µmol/l. Data available from Ndola Province (1988) show that VAD is a significant public health problem with XN rates as high as 5.0% in rural areas and 13.6% of the total population of 6–12-year-olds having serum retinol levels <0.70 µmol/l.
Zimbabwe	1991	2011	0.6 (4.8)	X[E]		0.40	804	No national data. VAD prevalence data (1991) available on 6 districts indicate a low level of acute clinical xerophthalmia in an unspecified age group. Only a single district surpassed WHO criteria (>1% XN), while two districts had alarmingly high rates of corneal xerophthalmia attaining 0.56%.

* Refer to *Interpreting data in the MIDS* pg. 15

Prevalence of Vitamin A Deficiency

Region of the Americas

April 1995

SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - REGION OF THE AMERICAS

Country	Year	Population * (000)	PREVALENCE*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
Antigua & Barbuda								No data available. No problem likely.
Argentina		3272					?	Survey in Greater Buenos Aires found that 23.8% of children <1 year of age and 28% of children aged 1–2 year had less than the recommended daily intake of vitamin A.
Bahamas		25						No data available. No VAD likely.
Barbados		20						No data available. No VAD likely.
Belize	1990	34			10.0	0.40	14	Biochemical data available from a national survey (1990) showed that 10% had serum retinol levels <0.70 µmol/l, indicating a mild to moderate subclinical VAD problem. Although the surveyed 2–8-year-olds had acceptable serum retinol levels (mean 1.03 µmol/l), over 60% had inadequate hepatic stores (RDR > 20%). Evidence points to differences between ethnic groups in risk patterns, i.e. Garifuna and Kekchi Indians (South of country) had highest rates of VAD.
Bolivia	1991	1178			11.3	0.40	471	National data (1991) from the poorest areas of the country indicate that 11.3% of children 1–5 years of age have serum retinol levels <0.70 µmol/l, those living in areas of high population density (urban areas) being affected the greatest by severe subclinical VAD. Clinical deficiency was not reported as compared to an earlier national survey (1985) which found a XN rate of 2.3%. Vitamin A capsules have been distributed to those <5 years of age living in high risk areas.
Brazil	1989	16 894		54.7		0.25	4224	Survey in Paraiba (1983) found a moderate to severe rate of X1B (0.5%). Comprehensive biochemical data are available from Coastal Region, Paraiba and the Northeast Region of the country and have consistently demonstrated high prevalences of subclinical VAD. A survey in the Bahia-Semi Arid region (1989) on children aged 0–6 years found that 54.7% had serum retinol levels of <0.70 µ mol/l. Survey of daily energy intakes found an inadequate consumption of available local foods rich in vitamin A.
Canada	197?	1986						VAD not considered a public health problem.

* Refer to *Interpreting data in the MIDS* pg. 15

SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - REGION OF THE AMERICAS

Country	Year	Population * (000)	PREVALENCE*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
Chile		1514						Old national data (1960) indicated that 21.6% of children had inadequate vitamin A intake (serum retinol <0.70 µmol/l), but no recent information is available. No evidence of current problem.
Colombia	1977	3875		24.1		0.40	1550	No current data available. Old survey (1960) indicated that 16% of children had serum retinol levels <0.70 µmol/l, while later survey data (1977) documented higher levels still with >20% below this cut-off. No children, however, had serum retinol <0.35 µmol/l.
Costa Rica	1981	420						National data (1981) have demonstrated that VAD is not a severe public health problem, with only 1.8% of preschool children having serum retinol levels <0.70 µ mol/l.
Cuba		930					?	No data available. Subclinical VAD likely.
Dominica							?	No data available.
Dominican Republic	1991	997	2.8 (11.2)		19.6	0.40	399	No national data. Biochemical survey undertaken in Southwest region bordering Haiti (1991) indicated that 19.6% of preschool children had serum retinol levels <0.70 µmol/l, with 4% showing levels <0.35 µmol/l. A hospital study in Santa Domingo (1991) found a xerophthalmia rate of 2.8%.
Ecuador	1993	1549			16.3[E]	0.40	620	National survey in five poor provinces (1993) found that 21.9% of those surveyed had serum retinol levels <0.70 µmol/l. National nutrition survey (1986) measured serum retinol in preschool children and noted that 14.1% had serum retinol levels <0.70 µmol/l, with a somewhat higher proportion in rural areas (16.4% <0.70 µ mol/l). In dietary surveys, preschool children consumed just over 50% of recommended vitamin A levels, while 81.3% of those children living in rural highlands had dietary patterns which provided <50% of the recommended vitamin A intake. Vitamin A capsules were distributed to the 1–6-year-old population during 1988–1990.
El Salvador	1988	857		36.0		0.40	343	The American Foundation for the Blind conducted a national survey (1973) which found a low prevalence of clinical xerophthalmia (X1B=0.05%), although more recent biochemical data (1988) indicate significant subclinical VAD with 1 out of every 3 preschool children having serum retinol levels <0.70 µmol/l, the highest risk areas being rural.

* Refer to *Interpreting data in the MIDS* pg. 15

SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - REGION OF THE AMERICAS

Country	Year	Population * (000)	PREVALENCE*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
Grenada								No data available. No VAD likely
Guatemala	1986 1988-89	1788		26.0[E]		0.40	715	Limited clinical data in rural areas (1986) on 0–10-year-olds have indicated a total xerophthalmia rate of 0.5%. However, biochemical data in rural areas collected in 1988 and 1989 have noted as many as 26% of children under 5 years of age with serum retinol levels <0.70 μmol/l. Evaluation of a sugar fortification trial undertaken over 2 years between 1975–77 saw a drop in low retinol levels from 18.7% to 8.3%.
Guyana	1976	94					?	PAHO survey (1976) found no clinical signs of deficiency, though 5.4% of those tested (7.4% in urban areas) had serum retinol levels <0.35 μmol/l.
Haiti	1975	1083	8.0 (52.0)	X		0.60	650	National survey (1975) of an unspecified age group observed a total xerophthalmia rate of 8%, and estimated that as many as 2.5% of the children had corneal involvement. Haiti has a national VAD control program based primarily on capsule distribution, although HKI has also emphasized the production and consumption of vitamin A-rich foods.
Honduras	1987	960			20.0	0.75	720	National nutritional survey (1987) found that 20% of the children had retinol levels <0.70 μmol/l. It also indicated that almost 75% of all families consumed <50% of the recommended vitamin A. VITAL has supported a rapid appraisal of VAD status, but data are not yet available.
Jamaica		266						No data available. No VAD likely.
Mexico	1990	11 912		32.0		0.40	4765	No national data. Data from Hermosilla (1990) indicated that 32% of children 2–7 years of age had serum retinol levels <0.70 μmol/l. Data from Yucatan (1984) indicated clinical deficiency among displaced persons.
Nicaragua	1993	769		31.3		0.40	308	USAID preliminary biochemical results (1993) found that 7.9% of the population studied was deficient (<0.35 μmol/l) and that 31.3% had marginal serum levels (<.70 μmol/l). Old national data (1966) indicate approximately 20% of children aged 0–4 years had serum retinol levels <0.70 μmol/l. A nutritional study (1982) in the northern and central areas found that children aged 7–12 years consumed <10% of the recommended amount of fruits and vegetables. No recent biochemical studies done.

* Refer to *Interpreting data in the MIDS* pg. 15

SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - REGION OF THE AMERICAS

Country	Year	Population * (000)	PREVALENCE*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
Panama	1992	309						National data (1992) indicated mild levels of VAD with 6.0% of children under 15 years of age having serum retinol levels <0.70 µmol/l. VAD is not a problem at the public health level, but it appears that preschoolers are at risk of inadequate vitamin A intakes, especially indigenous people who tend to have lower retinol levels.
Paraguay	1965	716					?	Old national data (1965) indicate that approximately 12% of children under 14 years of age had serum retinol levels <0.70 µmol/l. No recent data available.
Peru	1992	3010		22.0[5]		0.40	1204	No clinical data available. Biochemical data from Piura and Puno provinces (1992) indicate a high proportion of inadequate vitamin A intake (retinol levels <0.70 µmol/l) in 32.8% of children 0–6 years of age and 14.1% of preschool children, respectively. Other information on VAD from older dietary surveys (1970s) note that almost all families surveyed in Puno province consumed <50% of the recommended level of vitamin A. Other provinces of Piura, Junin and Lima-Callao also had marginal vitamin A intakes.
Puerto Rico		315						No data available.
St. Kitts & Nevis								No data available. No VAD likely.
St. Lucia								No data available. No VAD likely.
St. Vincent & the Grenadines								No data available. No VAD likely.
Suriname		55					?	No data available.
Trinidad & Tobago		144						No data available. No VAD likely.

* Refer to *Interpreting data in the MIDS* pg. 15

SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - REGION OF THE AMERICAS

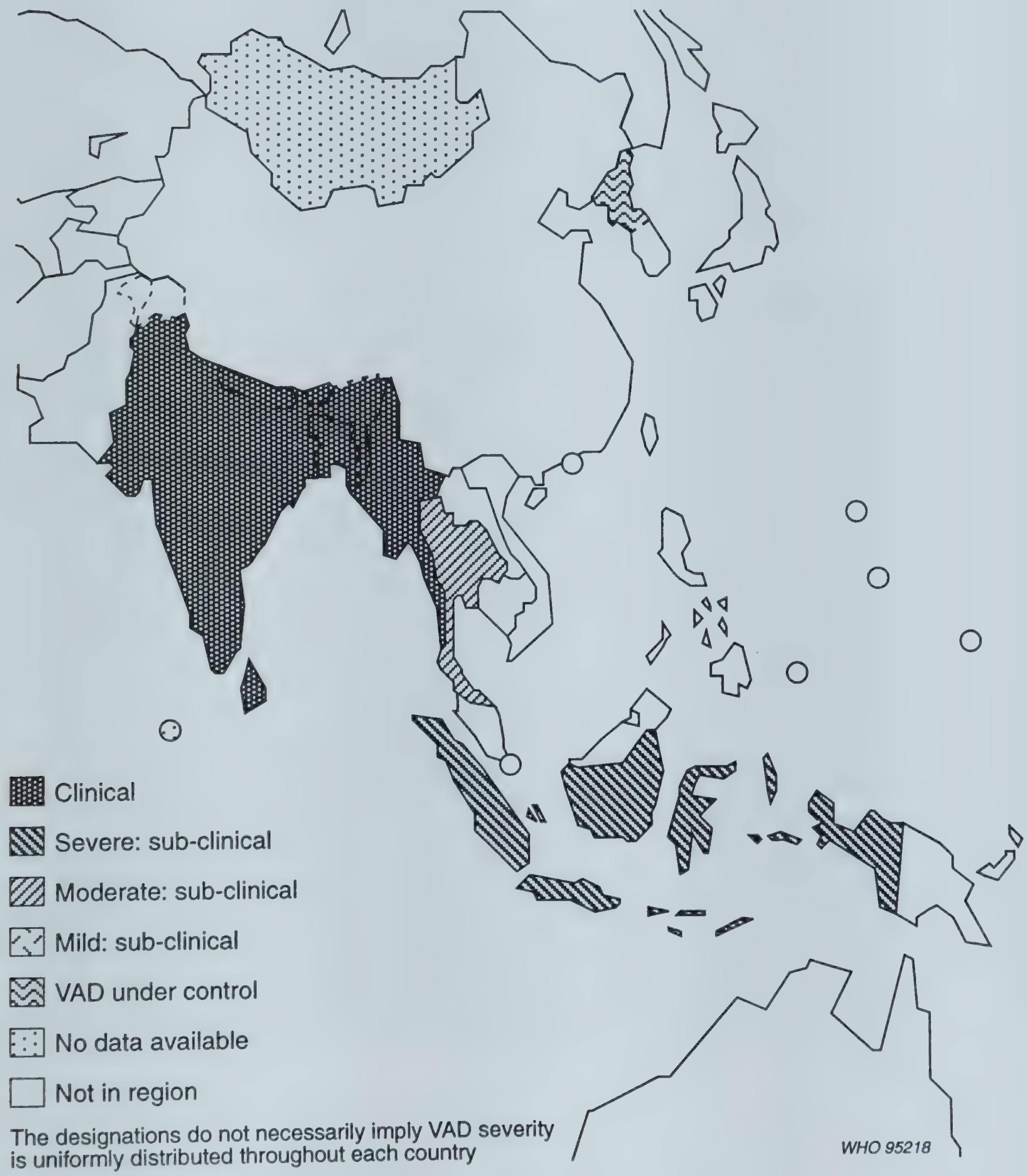
Country	Year	Population * (000)	PREVALENCE*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
United States of America	1970s–1980s	20 344						Data from Health and Nutrition Examination surveys (1970s–1980s) and studies of Mexican Americans, Puerto Ricans and African Americans (1970s–1980s) indicate mean serum retinol levels between 1.04 and 1.31 µmol/l. Data from Mexican Americans in the southwest (1982–83) found that only 4.6% had serum levels <0.70 µmol/l and that non-Hispanic blacks and whites had mean serum levels of 1.04 µmol/l and 1.15 µmol/l, respectively. Only 10% of those surveyed (1982–83) had serum retinol levels <0.70 µmol/l.
Uruguay	1962	262						Old data from a nutritional survey (1962) showed no evidence of clinical or biochemical hypovitaminosis A.
Venezuela	1960	2566						Old national data (1960) indicated that between 5–8% of children <14 years of age had serum retinol levels <0.70 µmol/l, but no recent data on vitamin A status are available.

* Refer to *Interpreting data in the MIDS* pg. 15

Prevalence of Vitamin A Deficiency

South-East Asian Region

April 1995



SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - SOUTH-EAST ASIA REGION

Country	Year	Population * (000)	PREVALENCE*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
Bangladesh	1983	19 633	4.6 (678.8)			0.75	14 725	A large-scale national blindness survey (1982–83) provides the most up-to-date estimate of VAD in the country. Rural areas had the following rates of clinical xerophthalmia: XN=3.6%, X1B=0.9%, corneal involvement =0.1%. Urban slum areas: XN=2.8%, X1B=1.6%, corneal involvement =0.2%. The total xerophthalmia rate was 4.6%. The sample design was proportional to the population distribution, found primarily in rural areas, and thus was similar to the overall rates which were: XN=3.5%, X1B=1.0%, corneal involvement=0.1%. This translates to 11 cases per 10 000 or 11 times greater than WHO considers to be a severe public health problem. Biochemical data from Matlab (1980) found 20% of preschool children to have serum retinol levels <0.35 µmol/l. VAD in Bangladesh is linked to the heavy dependence on a diet of rice. Surveys have showed low levels of vitamin A intake on a national basis and efforts are under way to improve dietary diversity through increased production and consumption of vitamin A-rich foods.
Bhutan	1989	277	0.7 (1.4)	X		0.75	208	A large-scale national nutrition survey (1989) was undertaken during which signs of clinical xerophthalmia were noted. A total xerophthalmia rate of 0.7% among children aged 0–5 years confirmed an earlier observation (1976) of moderate to mild clinical xerophthalmia. However, a national biochemical study (1985) noted that 14% of preschool children and 13% of pregnant women had serum retinol levels <0.35 µmol/l indicating a significant subclinical VAD problem. Dietary information from 1981–82 shows that 88% of households consume less than the RDA.
Democratic People's Republic of Korea		2687						No data available. No VAD likely.

* Refer to *Interpreting data in the MIDS* pg. 15

SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - SOUTH-EAST ASIA REGION

Country	Year	Population * (000)	PREVALENCE*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
India	1988–90	115 894	0.7 (608.4)			0.75	86 920	Over the past 10–15 years VAD rates have been monitored by the National Nutrition Monitoring Bureau (NNMB) which have noted that the prevalence of X1B has declined between 1976 and 1990 from 2.0 to 0.7%. One survey (1988–90) found a X1B rate of 0.7%. A baseline survey (1989) for a vitamin A supplementation trial in Tamil Nadu noted high xerophthalmia rates, including XN=3.7%, X1B=7.2% and total xerophthalmia rate = 10.95%. Biochemical data from the same survey found that 37.5% had retinol levels <0.70 µmol/l. India has a comprehensive strategy to combat VAD, primarily through vitamin A supplementation. Home gardening and education programs have been initiated in three states.
Indonesia	1991	23 532		50-65		0.60	14 119	Over the past fifteen years, most of the pioneering work in vitamin A control programme development and research has taken place in Indonesia, including evaluation of the mortality effects of vitamin A supplementation and trials with MSG fortification. A large-scale national prevalence survey (1977–78) of children aged 0–5 years found an overall X1B prevalence of 1,0%, corneal xerophthalmia of 0.06% and XS of 0.13% indicating a severe problem in the past. Between 1983 and 1990, many of the provinces earlier identified as having the highest xerophthalmia rates were re-surveyed, and considerable reduction were noted. Later studies in several provinces (1991) were showing total xerophthalmia rates of <1.0%. However, biochemical studies showed that >50% of those surveyed had serum retinol levels <0.70 µmol/l. Vitamin A supplementation activities have been extended to include home gardening and education to promote the consumption of vitamin A-rich foods.
Maldives	1977	42						A country report on Felidu Island (1977) of children <6 years of age found no cases of xerophthalmia, though results seem to be dependent on the availability of fish, liver and greens.
Mongolia		371						No available data.

* Refer to *Interpreting data in the MIDS* pg. 15

SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - SOUTH-EAST ASIA REGION

Country	Year	Population * (000)	PREVALENCE*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
Myanmar	1987–89	6509	2.0 (78.1)	32.4[B]		0.60	3905	No national data. Large-scale study undertaken in central Myanmar (1978–1990) noted some high levels of X1B ranging from 0.7% in Natogyi to 3.3% in Saku (though considerably smaller sample size in latter region). A survey conducted in dry upper zone (1987–89) of 4 regions observed X1B of 2.0% among children aged 2–5 years, but somewhat higher rates in school-age children, including >9% of 10–14-year-olds in Monywa. Biochemical data from the same study noted a similar range in serum retinol values with as much as 76.1% of children aged 2–6 years living in Kyaukpadaung having serum retinol levels <0.70 µmol/l and over 16% with values <0.35 µmol/l.
Nepal	1981 1993	3442	3.0[E] (77.5)			0.75	2582	Nepal had a large-scale blindness xerophthalmia survey (1981) in which the overall prevalence of X1B among children aged 0-6 years was 0.64%. However, there was considerable variation in the distribution within the country, with the highest rates observed in the Terai region along the border with India. A large intervention study in the Central Terai noted X1B prevalences above 2% (districts of Bara and Parsa at baseline in 1989). A survey undertaken in the Jumla district (1990) noted a 13.2% prevalence of active xerophthalmia in preschool children. Surveys in the far and midwest (1993) found X1B rates around 3.0%.
Sri Lanka	1987	1793	0.3 - 0.7 (3.7)			0.40	717	A national prevalence survey (1987) an average X1B prevalence of 0.3 %. Of the districts surveyed, Kegalle and Kurunegala had an average X1B prevalence of 0.70%. Subsequently, the Ministry of Planning and Implementation published VAD prevalence data for all districts which indicate the problem may be even more widespread.
Thailand	1990 1992	5576			20.0	0.25	1394	No national data. Survey in the south (1992) found a XS rate of 0.90% and corneal involvement of 0.67%. Problem seemed to be isolated to south due to use of unfortified condensed milk during infant feeding. Data available from Sakon Nakhon province (1990) in the northeast part of the country reported a 0.0–1.3% prevalence of XN among children aged 2–6 years in rural areas, depending on season. An important seasonal difference has been noted in the vitamin A levels of preschool children in the north and northeast, with serum retinol means being significantly higher in the months of September and October (1.3 µmol/l) when compared to those found in February and March (1.02 µmol/l). MOH reports no clinical cases since early 1994.

* Refer to *Interpreting data in the MIDS* pg. 15

Prevalence of Vitamin A Deficiency

European Region

April 1995

The designations do not necessarily imply VAD severity is uniformly distributed throughout each country

SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - EUROPEAN REGION

Country	Year	Population * (000)	PREVALENCE*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
Albania		358						Rapid assessment of eight districts (1991) found little evidence of VAD.
Armenia		351						No data available.
Austria		454						No data available.
Azerbaijan		787						No data available.
Belarus		596						No data available.
Belgium		603						No data available.
Bosnia and Herzegovina		220						No data available.
Bulgaria		449						No data available.
Croatia		249						No data available.
Czech Republic		1094						No data available.
Denmark		323						No data available.
Estonia		83						No data available.
Finland		319						No data available.
France	1985–86	3826						Study in Tours (1985–86) of 1–16-year-olds recorded a serum retinol mean of 1.47 μmol/l. Nutritional Study on 0–3-year-olds throughout twenty day-care centres in Paris found that more than 70% of the vitamin A RDA was received while at day care.
Georgia		417						No data available.
Germany		4571						No data available.

* Refer to *Interpreting data in the MIDS* pg. 15

SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - EUROPEAN REGION

Country	Year	Population * (000)	PREVALENCE*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
Greece		526						No data available.
Hungary		636						No data available.
Iceland		23						No data available.
Ireland		248						No data available.
Israel	1970s	582					?	No national data. A small survey (1970s) of low-income Arab children living in East Jerusalem noted that 83% of girls and 86.9% of boys had serum retinol levels <0.70 µmol/l with mean serum retinol values of approximately 0.60 µmol/l.
Italy		2883						No data available.
Kazakhastan								No data available.
Kyrgyzstan								No data available.
Latvia		181						No data available.
Lithuania		273						No data available.
Luxembourg		23						No data available.
Malta		27						No data available.
Monaco								No data available.
Netherlands		1048						No data available.
Norway		317						No data available.
Poland		2708						No data available.

* Refer to *Interpreting data in the MIDS* pg. 15

SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - EUROPEAN REGION

Country	Year	Population * (000)	PREVALENCE*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
Portugal		564						No data available.
Republic of Moldova		339						No data available.
Romania	1970s	1775					?	Only data available are from a survey (1970s) of 117 orphans which resulted in a mean serum level of 0.74 μmol/l (± 0.33).
Russian Federation		22 845						No data available.
San Marino								No data available.
Slovakia		373						No data available.
Slovenia		102						No data available.
Spain		2101						No data available.
Sweden		606						No data available.
Switzerland		433						No data available.
Tajikistan		986						No data available.
The former Yugoslav Rep. of Macedonia		158						No data available.
Turkey	1985–86 1994	7779					?	No national data available. Small study done in Marmara in central and east Anatolia (1986) of 150 children aged 7–17 years. Biochemical measures were taken and an overall mean serum retinol level of 1.18 μmol/l (± 0.46) was observed, with consistent levels across age groups and no differences by sex. Another survey (1994) of 56 children receiving measles immunizations found that 9.5% of the healthy, 42.9% of sick controls, and 90.5% of the measles group had serum retinol levels <0.70 μmol/l.

* Refer to *Interpreting data in the MIDS* pg. 15

SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - EUROPEAN REGION

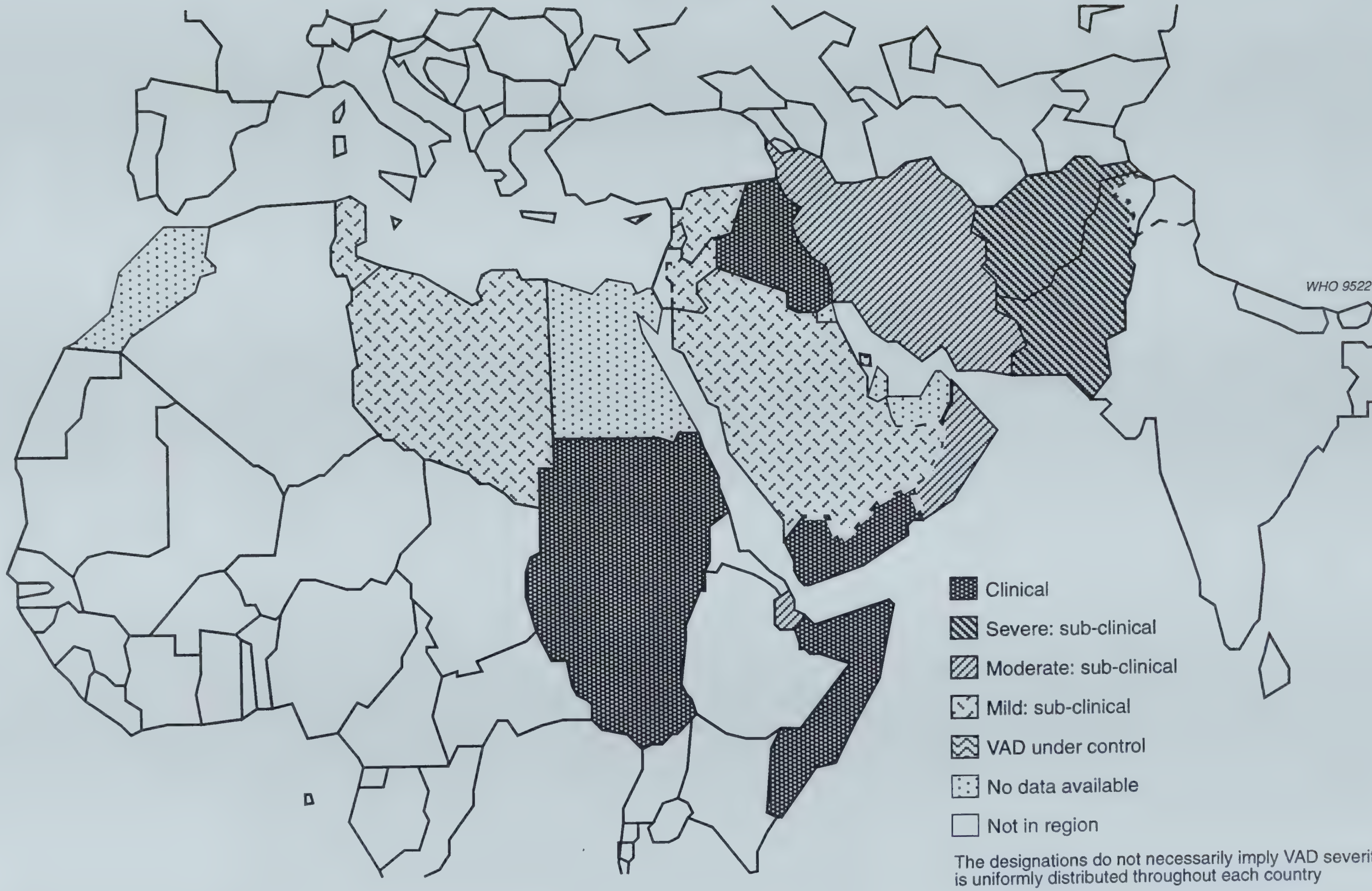
Country	Year	Population * (000)	PREVALENCE*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
Turkmenistan		577						No data available.
Ukraine		2884						No data available.
United Kingdom of Great Britain and Northern Ireland		3969						No data available.
Uzbekistan	1993	3222		X			?	Data from Muynak District (1993) found that 48.9% of children aged 5–6 years had serum retinol levels <0.70 µmol/l.
Yugoslavia		1645						No data available.

* Refer to *Interpreting data in the MIDS* pg. 15

Prevalence of Vitamin A Deficiency

Eastern Mediterranean Region

April 1995



Summary of Vitamin A Deficiency Prevalence Data - Eastern Mediterranean Region

Country	Year	Population * (000)	Prevalence*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
Afghanistan	1989	4250		X			?	Study in Kabul (1989) indicated a 2.4% X1A rate among children between the ages of 5–14 years. No biochemical data are available.
Bahrain		69						No data available. VAD not considered a public health problem.
Cyprus		60						No data available. No VAD likely.
Djibouti	1988	95			16.0[E]	0.40	38	Comprehensive survey (1988) of children aged 0–5 years available including biochemical and clinical parameters for rural and urban areas. The prevalence of X1B was found to be 1.04% in rural areas, while in urban areas it was 0.43%. However, biochemical data on children aged 4–10 years gave a different impression, with 12.3% of rural children having serum retinol levels <0.70 µmol/l, but over 20% of urban children falling below the 0.70 µmol/l cut-off. These data were further confirmed by CIC (with transfer) where 13.6 % of the urban children had morphology indicative of VAD, while only 8.3% of the rural children were classified as vitamin A deficient.
Egypt	1978	7798					?	Very few studies exist. Survey by MOH (1978) found VAD among 0.5% of children sampled. Though small, unrepresentative assessments do not suggest a VAD problem, the UNICEF regional office (Amman) reports that it is.
Iran (Islamic Republic of)	1980s	11 589			X		?	No national data. In a UNICEF report *Situation of Women and Children in Iran*, several survey data were summarized including biochemical information from 4 provinces (1980s) where 9% of preschool children had serum retinol levels <0.70 µmol/l. In studies in Kohguiluyeh and Boyerahmad, no boys aged 7–17 years had serum retinol levels <0.35 µmol/l. In a goitre endemic area of Teheran, no girls surveyed had serum retinol <0.70 µmol/l.
Iraq	1994	3574	1.6 (14.3)	X[E]		0.25	893	No national data available. UNICEF preliminary data from health centres in Baghdad, Basrah and Mosul (1994) found a XN rate of 1.6%. In a rapid situational assessment in Hartha (1992) following the Gulf War, a 2.9% XN rate and 1.4% X1B rate were observed in preschool children (95% CI 0.2–5.7) while an examination of 16 malnourished children in Basrah yielded one case of Bitot's spots. Furthermore, there is a high incidence of diarrhoea (52.5–59.8%) and respiratory disease (2.7–5.5%).

* Refer to *Interpreting data in the MIDS* pg. 15

SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - EASTERN MEDITERRANEAN REGION

Country	Year	Population * (000)	PREVALENCE*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
Jordan		832					?	Old survey (1960) noted a 1.27% XN rate. Nutritional survey (1975) of children aged 0–5 years showed a clinical prevalence of 0.05%. No current data, though the UNICEF regional office reports that VAD is of public health significance.
Kuwait		223						No information available. UNICEF regional office believes that VAD is not a serious problem in the country.
Lebanon		376					?	Data not yet available from a survey conducted in late 1994. An old nutrition survey (1962) showed that 3% of children aged 5–9 years had serum retinol levels <0.35 µmol/l. No signs of Bitot's spots were seen in 98 children aged 0–4 years. UNICEF regional office considers VAD to be likely.
Libyan Arab Jamahiriya		959					?	No data available. UNICEF regional office considers VAD to be likely.
Morocco	1971	3955					?	Old national data (1971) indicates a 1% total xerophthalmia rate for children under four years of age. No recent data available.
Oman	1994	328			20.8	0.60	197	National survey (1994) found that 20.8% of those surveyed had serum retinol levels <0.70 µmol/l, indicating a moderate to severe subclinical problem. Children 18 months of age were affected the most with 22.8% having serum retinol levels <0.70 µmol/l. Data from 12 MCH Centres (1981) noted X1B prevalences to be 1.5% with higher rates in boys than in girls. However, more recent data (1991) on children aged 0–2 years found no cases of clinical xerophthalmia, indicating that clinical VAD may be under control. Supplementation programs have been proposed for 1995.
Pakistan	1990 1988–89	22 550	0.0	29-70[s]		0.40	9020	Clinical xerophthalmia observed in several small studies in Lahore and West Pakistan in 1960s. A national micronutrient survey (1976–77) reported a X1B rate of 1.5% in preschool children. Biochemical data from the same survey noted that 13.0% of school-age children had serum retinol levels <0.70 µmol/l, although it was noteworthy that only 2.1% of lactating mothers had marginal serum vitamin A. A survey in Orangi (1987) found a X1B rate of 3.8%. Smaller surveys (1988–89) in several urban slums of Karachi (Azambasti, Chenesar-Goth and Esanagri Gilgit) found no signs of xerophthalmia though the biochemical data indicate that VAD is a public health problem with 29–70% of preschool children having serum retinol levels <0.70 µmol/l.

* Refer to *Interpreting data in the MIDS* pg. 15

SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - EASTERN MEDITERRANEAN REGION

Country	Year	Population * (000)	PREVALENCE*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
Qatar		51					?	No data available. UNICEF regional office reports that VAD is unlikely.
Saudi Arabia	N.S.	2822					?	No national data. Results of a biochemical study in Riyadh indicate that 10% of the population surveyed had serum retinol levels <0.70 µmol/l and that 1.1% had serum values <0.35 µmol/l, indicating that VAD is not a severe problem.
Somalia	1993	2003	1.5[ε] (7.5)		X[ε]	0.25	500	WHO's National Morbidity Survey (1982) showed that hypovitaminosis A was not a public threat. Reports of VAD occurred after the Civil War in central, southern, northwest and northeast zones. Nutritional surveys in central Somalia report 1–2% of X1B.
Sudan	1986–87 1989	4989	1.6[ε] (59.9)			0.75	3742	No national data. However, clinical surveys conducted in many of the provinces have indicated that VAD is a significant public health problem. Studies (1986–87) found XN prevalence rates ranged from approximately 0.5% in Gezira, Kassala, Nile and Northern areas to above 2% in Khartoum, Darfur and Kordorfan. Studies done in refugee camps have observed alarmingly high levels of clinical xerophthalmia, but these were all based on very small sample sizes. In the Red Sea Province (1989), xerophthalmia is around 1.6%. Food consumption survey in Upper Nile (1978) found that a normal diet contained only 6-10% of RDA. No biochemical data available.
Syrian Arab Republic		2746					?	No data available. UNICEF regional office considers VAD to be likely.
Tunisia		1089					?	No recent data available. A nutritional survey (1975) concluded that hypovitaminosis A was not a problem, though UNICEF regional office considers VAD to be likely.
United Arab Emirates		177						No data available. UNICEF regional office considers VAD to be likely.
Yemen	1992	2705	2.1 (42.6)	62.4		0.75	2029	Preliminary data from 21 villages in the Tihama region (1992) observed an overall X1B rate of 1.7% and a total of 2.14% in children aged 1–6 years. It is noteworthy that the prevalence of X1B was directly related to age, with the highest X1B rates seen in children 5–6 years of age (2.94%). It was found that 62.4% of children aged 1–5 years showed serum retinol levels <0.70 µmol/l. Survey of health centres (1981) found no keratomalacia, acute corneal xerosis or ulceration.

* Refer to *Interpreting data in the MIDS* pg. 15

Prevalence of Vitamin A Deficiency

Western Pacific Region

April 1995

The designations do not necessarily imply VAD severity is uniformly distributed throughout each country

WHO 95221

Summary of Vitamin A Deficiency Prevalence Data - Western Pacific Region

Country	Year	Population * (000)	Prevalence* Clinical	Severe sub-clinical	Moderate sub-clinical	Multiplication factor*	Population at risk* (000)	Notes
Australia		1352						No data available. No VAD likely.
Brunei Darussalam		32						No data available. No VAD likely.
Cambodia	1993	1505	6.9 (77.9)			0.75	1129	No national data. Survey of 5 provinces (1993) found a XN rate of 6.3% and a X1B rate of 0.6%
China	1982	120 386			18.5E	0.25	30 096	National data from urban Beijing (1982) found 17% of 0–2 year olds had serum levels <0.70 µmol/l. Study of rural children notes that as many as 20% of children between 6 months and 2 years of age have serum retinol levels <0.70 µmol/l. Dietary surveys in rural areas show that children <3 years of age consume only 30–40% of the RDA of vitamin A. Xerophthalmia and blindness caused by VAD is rare. Largest XN rate was found in Talep (11.0%) and Kompong Thom (9.8%).
Cook Islands	1989–92		0.0				?	Surveys done in high-risk malnutrition areas to determine severity of VAD. Results found no cases of xerophthalmia.
Fiji		84						No data available. No VAD likely.
Japan		6912						National nutritional survey (1988) of 20 000 people showed an intake of 2596 IU per capita per day.
Kiribati	1994		1.1 (?)			0.75	?	Survey of three villages on Kiritimati Island (June 1994) found a xerophthalmia rate of 1.12% (X1A, X1B) among 0–6-year-olds. However, national data from the Gilbert islands (1989) indicate that VAD may be quite severe, with 14.7% of preschool children aged 6 months to 5 years with xerophthalmia, 10.9% from X1B. Short-term vitamin A supplementation programme is almost completed.
Lao P.D.R.	1995	887		X		0.40	355	National survey (1995) found that among children ages 24–71 months, 0.7% reported nightblindness. One child reported Bitot's spots and another had an active corneal ulcer. Low intake of dark green leafy vegetables. No other data are available.

* Refer to *Interpreting data in the MIDS* pg. 15

Summary of Vitamin A Deficiency Prevalence Data - Western Pacific Region

Country	Year	Population * (000)	Prevalence*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
Malaysia	1984	2656			12.0	0.25	664	No national data. Data from the coastal and river area (1978) indicate cases of VAD, especially in Sarawak River Delta where a xerophthalmia rate of 38.2% was found. Biochemical data (1984) from a rural area in peninsular Malaysia found that 12% had serum retinol levels <0.70 µmol/l. However, severe problem seems to be confined to certain areas such as rural areas and does not seem to pose a public health problem.
Marshall Islands	1991		4.0			0.75		UNICEF survey (1991) found a xerophthalmia rate of 4.0%.
Micronesia (Federated States of)	1988–89		20 (?)	64.0		0.25	?	National data available from Chuuk (1988–89) found an alarmingly high prevalence of xerophthalmia with XN rates of 14.0% and X1B rates of 6.0% in children 3–7 years of age. Subsequently, serum retinol levels of these children were found to be very low with 15% <0.35 µmol/l and 64% <0.70 µmol/l.
Nauru								No data available.
New Zealand		300						No data available.
Niue								No data available.
Papua New Guinea	1993 1990s	644	0.6 (1.0)	91.0		0.25	161	Study done in hospitals throughout 9 provinces (1993) found that 0.59% suffered clinically from VAD. VAD suspected to exist from available data in East Sepik where 91% had serum retinol levels <0.70 µmol/l.
Philippines	1993	9421	0.4 (15.1)			0.40	3768	National nutritional survey (1993) found a XN prevalence of 0.7% among children 6 months to 6 years of age. A steady decrease has been documented through the past decade by surveys undertaken in 1982 and 1987 which found national estimates of XN decreasing from 3.5% to 0.9%. Biochemical results from a national vitamin A deficiency prevalence survey (1987) found that 2.6 % of the preschool children had serum retinol levels <0.35 µmol/l. Studies in Samar and Zamboanga (1991) indicate that VAD is still highly prevalent in some areas, with X1B rates of over 2% observed in preschool children aged 0–5 years.
Republic of Korea		3548						No data available. No VAD likely.
Samoa								No data available. No VAD likely.

* Refer to *Interpreting data in the MIDS* pg. 15

SUMMARY OF VITAMIN A DEFICIENCY PREVALENCE DATA - WESTERN PACIFIC REGION

Country	Year	Population * (000)	PREVALENCE*			Multiplication factor*	Population at risk* (000)	Notes
			Clinical	Severe sub-clinical	Moderate sub-clinical			
Singapore		219						No data available. No VAD likely.
Solomon Islands	1991	64	1.5 (0.7)			0.75	48	Data from 7 islands (1991) noted an average X1B prevalence of 1.42% among preschool children and a total xerophthalmia rate of 1.52% in children aged 0–5 years.
Tokelau								No data available.
Tonga								No data available.
Tuvalu	1991		0.0				?	National survey found no cases of xerophthalmia.
Vanuatu	1991	27	0.05			0.75		National survey found corneal xerosis rate of 0.05%.
Viet Nam	1988	9630	0.6 (34.7)			0.60	5778	National data (1994) reveals that xerophthalmia is no longer a problem in the country. Among children <5 years of age, a prevalence of 0.14% was found. Earlier national data (1988) found an overall xerophthalmia prevalence to be around 0.65% of which a majority of the clinical symptoms and signs noted were XN (0.35%). However, the rate of corneal xerophthalmia was 0.13%, well above the criteria set by WHO to classify countries as having a significant VAD public health problem. FAO has implemented a number of home gardening studies which are being evaluated.

* Refer to *Interpreting data in the MIDS* pg. 15

MDIS

Global Prevalence of Vitamin A Deficiency

Disaggregated Data Tables

GUIDELINES FOR USING DISAGGREGATED TABLES

Information on VAD prevalence in this section is presented in two sets of tables:

Ocular signs and symptoms
Serum retinol data

For each set, data are presented for countries in alphabetical order according to the six WHO regions. For each country there is a brief description of the location and population under study in the column marked ***Geographic area***, together with any other defining characteristics of the region or area. The ***Survey year*** refers to the year in which the study was conducted or ended if it spans more than one year. ***N.S.*** (not specified) is recorded if the survey year is unknown. The ***Age group*** is presented in years. ***Sex*** is divided into three categories each denoted by the following letters: B=both males and females; M=males only; F=females only. If the sex was not specified it is assumed that both sexes were assessed, and a 'B' is recorded on the table. ***Sample size*** refers to the number of children in a particular strata. If the sample size was not given, ***N.S.*** is inserted. Where no data are given in one or more of these columns for a particular survey, unless otherwise noted it is assumed that it is the same as the preceding survey.

For clinical data, point prevalence estimates are provided for individual signs and symptoms of clinical xerophthalmia and the total of corneal xerophthalmia (X2+X3A+X3B). Where a total xerophthalmia rate is available, the next column indicates the particular classification scheme used, i.e. the specific stages of xerophthalmia which are included in the estimate. It is very important to recall when comparing data across studies that disparate classifications were employed in many of the rates presented for total xerophthalmia

For serum retinol data, in addition to those characteristics outlined above, a column has been included to specify the laboratory method employed in the biochemical analysis and determination of serum retinol levels. The information for serum retinol is presented both as prevalence, i.e. percent of population falling below 0.70 and 0.35 μmol/l, as well as for the entire distribution, by designating the mean value and its standard deviation.

Reference numbers are coded according to WHO region where the first number corresponds to the following: 1=AFR; 2=AMR; 3=EMR; 4=EUR; 5=SEAR; 6=WPR; 7=Multiple country data. Specific references are listed in a separate section of the document.

PREVALENCE OF OCULAR SIGNS AND SYMPTOMS

- DISAGGREGATED TABLES -

Country	Geographic area	Survey year	Age group	Sex	Sample size	XN	X1A	X1B	X2	X3A	X3B	XS	Corneal	Total	*	Ref. No.
						Prevalence of ocular signs and symptoms										
AFRICAN REGION																
ANGOLA	Andulo, Bie Province	1973	0-4.99	B	N.S.			3.00							Z	7018
BENIN	Atacora region	1975	N.S.	B	1965			0.55	2.60		0.20			3.35	D	7001
	North Atacora	1989	0-4.99		1551	3.40		4.90								1041
BURKINA FASO	4 northern regions	1984	0-5		2786	2.10		12.00				0.00	0.30	14.40	B	7001
			16-45		1722	2.50		1.90				0.10	0.60	5.00		
	Bam		2-10		1263	0.36									Z	1035
			2-5		429	1.16										
			6-10		824	0.35										
	Gourma		2-10		1609	0.87										
			2-5		885	0.79										
			6-10		724	0.96										
	Passore		2-10		1260	1.58										
			2-5		664	1.80										
			6-10		596	1.34										
	Soum		2-10		1055	2.55										
			2-5		583	2.57										
			6-10		472	2.54										
	Tapoa		2-10		948	3.58										
			2-5		483	1.65										
			6-10		465	5.59										
	Yatenga		2-10		2628	0.60										
			2-5		1520	0.32										
			6-10		1108	0.99										
	Districts of Yatenga, Passore, Sourou	2/86	0-5.99		1103	2.82		0.27	0.00			0.09	0.18	3.27	B	7015
				F	N.S.	3.37		0.19	0.00			0.00	0.00	3.56		
				M		2.33		0.35	0.00			0.18	0.35	3.03		
			6-10	B	932	2.29		2.17	0.00			0.360	0.00	4.46		
				F	N.S.	2.10		1.47	0.00			0.00	0.00	3.57		
				M	N.S.	2.63		2.85	0.00			0.63	0.00	5.48		
	Passore - rural		0-5	B	107	0.00		0.00	0.00			0.00	0.00	0.00		
			6-10		94	1.55		2.13	0.00			0.00	0.00	3.68		
	- urban		0-5		95	4.41		0.00	0.00			0.00	0.00	4.41		
			6-10		104	2.88		1.92	0.00			0.00	0.00	4.80		
	Sourou - rural		0-5		226	2.98		0.00	0.00			0.00	0.00	2.98		
			6-10		177	5.10		0.56	0.00			0.00	0.00	5.66		
	Yatenga - rural		0-5		675	2.22		0.52	0.00			0.17	0.34	3.08		
			6-10		557	1.53		2.69	0.00			0.66	0.00	4.22		
	3 northern regions	1987	N.S		N.S.	5.12								13.2	Z	7001
	Six provinces	1989	2-10			1.42		0.26	0.03			0.03	0.05	1.73	B	
CAMEROON	Extreme Northern Province	4-5/92	0-5	B	5352	0.19		0.47			0.12			0.71	Z	7023
	Flooded plains				1644	0.00		0.43						0.55		
	Mountains				1986	0.35		0.65						1.00		
	Plains				1163	0.26		0.26						0.52		
	Periurban				559			0.36						0.54		
CAPE VERDE	San Vicente and Fogo	1982-83	4-70	F	616		3.40	2.90	0.00	0.00					Z	7016
				M	535		5.00	3.60	0.00	0.00						
CHAD	Rural areas	1984-86	0-4	B	1626			0.37			0.06	0.49			Z	1002
			5-9		1379			0.94			0.07	0.65				
	- drought camps		0-9		180			1.67			1.11	0.00				
	- equipped camps				559			0.00			0.00	0.72				
	- sedentary				2263			0.71			0.00	0.57				
	Subnational	1984	0-5		N.S.		2.20	0.50	0.00			0.40			Z	7001
	Chari-Baguirme, Bath, Ouaddi	3/86			1044	2.18		0.48	0.00			0.38	0.00	2.66	B	7015
				F	901	2.44		0.37	0.00			0.19	0.00	2.81		
				M	809	1.89		0.59	0.00			0.59	0.00	2.48		
			6-10	B	665	1.65		1.65	0.00			0.90	0.15	4.35		
				F	N.S.	0.82		1.37	0.00			0.82		2.19		
				M	N.S.	2.68		2.00	0.00			1.00	0.33	5.01		
	Batha - rural		0-5	B	481	1.37		0.21	0.00			0.42	0.00	1.58		
			6-10		318	1.89		1.57	0.00			1.57	0.31	3.77		
	Chari-Baguirme - rural		0-5		377	3.48		1.06	0.00			0.53	0.00	4.54		
			6-10		214	1.87		0.47	0.00			0.47	0.00	2.34		
	- urban		0-5		71	2.08		0.00	0.00			0.00	0.00	2.08		
			6-10		32	0.00		0.00	0.00			0.00	0.00	0.00		
	Ouaddi - rural		0-5		115	1.27		0.00	0.00			0.87	0.00	1.27		

* Total xerophthalmia rate: 'A' = XN-X3B, 'B' = XN-X3B, no X1A, 'C' = X1A-X3B, 'D' = X1B-X3B, 'Z' = Not specified

Country	Geographic area	Survey year	Age group	Sex	Sample size	Prevalence of ocular signs and symptoms										Ref. No.
						XN	X1A	X1B	X2	X3A	X3B	XS	Corneal	Total	*	
			6-10		101	0.99		5.00	0.00			0.00	0.00	5.99		
	Rural areas total		0-5		973	2.19		0.51	0.00			0.51	0.00	2.70		
			6-10		631	1.56		1.56	0.00			0.99	0.14	3.26		
ETHIOPIA	National	1980-81	.5-6.99	B	6636		4.80	1.00						5.90	C	1052
	- Cropping zone				3827		5.90	1.10						7.10		
	- Cash crop zone				1114		1.90	0.40						2.30		
	- Ensete zone				480		0.80	0.00						0.80		
	- Pastoral zone				1215		5.30	1.60						6.90		
	Shoa - 7 Provinces:	1981	6-20	B	14 740			0.91				1.40				1065
				F	5961			0.60				1.00				
				M	8779			1.10				1.60				
			6-10	F	2342			0.50				0.50				7016
				M	3954			1.00				1.80				
			11-14	F	3182			0.70				1.30				
				M	4068			1.20				1.80				
			15-18	F	426			0.90				1.60				
				M	705			1.60				2.70				
	Chebona-Gurage		6-20	B	5162			0.30								
				F	1457			0.10								
				M	3705			0.40								
	Kembatana Hadya			B	1836			0.30								
				F	773			0.30								
				M	1063			0.40								
	Menzena-Gishe			B	405			0.20								
				F	167			0.60								
				M	238			0.00								
	Merhabete			B	1333			1.80								
				F	629			1.40								
				M	704			2.10								
	Selate			B	867			2.30								
				F	374			1.10								
				M	493			3.20								
	Teguletna-Bulga			B	1374			0.60								
				F	676			0.40								
				M	698			0.70								
	Yifatna Timuga			B	3763			1.60								
				F	1878			2.30								
				M	1885			0.80								
	Sudan: Wad Kowli - Ethiopian refugees	1985	< 10	B	929		0.11	2.48	1.61			2.48		6.70	Z	1006
	Sudan: Wad Sherife - Ethiopian refugees				262		0.00	1.91	1.91			2.29		6.10		
	Camp Adi Gafuf - supplementary feeding		0-14.99		427		0.50	1.60				0.50	0.70	2.80	C	1029
	Camp Aji Bar - dry feeding		0-12.99		60		3.30	3.30				1.70	0.00	6.60		
	- intensive feeding				451		0.90	2.90				1.80	0.90	4.70		
	- super intensive feeding				110		0.00	0.90				0.90	0.00	0.90		
	- total				621		1.00	2.60				1.60	0.60	4.20		
	Camp Ansokia (Wello) - super intesive feeding		0-14.99		37		0.00	0.00				0.00	0.00	0.00		
	- intensive feeding				228		4.80	1.80				0.00	0.40	7.00		
	- total				265		4.20	1.50				0.00	0.370	6.07		
	Camp Bete		0-9.99		167		1.20	3.00				1.20	0.60	4.80		
	- general feeding				237		0.40	1.70				0.40	0.40	2.50		
	- monthly feeding				321		0.60	1.90				0.30	0.00	2.50		
	Camp Quiha - supplemental feeding		0-14.99		319		2.80	0.90				0.90	0.60	4.30		
	Arsi and Bale		.5-6.99		2647		16.36	3.89				0.42	0.60			
	Arsi				1241		20.47	6.29				0.64	0.73			1004
	Bale				1406		12.73	1.78				0.21	0.50			
	Debara School: Arsi	1987	7-16		175	29.00										
				F	43	18.30										7016
				M	132	32.50										
	Illo: Arsi		2-15	B	475	43.60										
				F	212	39.10										
				M	263	47.10										
	Bahir Dar School: Gojjam		4-6	B	538	1.85										
				F	272	1.83										
				M	266	1.87										
	Jima School: Keffna		5-6	B	706	1.27										
				F	363	1.60										
				M	343	0.87										

* Total xerophthalmia rate: 'A' = XN-X3B, 'B' = XN-X3B, no X1A, 'C' = X1A-X3B, 'D' = X1B-X3B, 'Z' = Not specified

Country	Geographic area	Survey year	Age group	Sex	Sample size	XN	X1A	X1B	X2	X3A	X3B	XS	Corneal	Total	*	Ref. No.
						Prevalence of ocular signs and symptoms										
	Melkaye village: Hararge	1990s	0-12.5	B	240	28.75		6.67	0.83			5.83	6.25			1073
	-with signs of xerophthalmia			F		12.10										
				M		12.90										
	-without signs of xerophthalmia			F		25.00										
				M		32.30										
GHANA	Kassena-Nankana	1989-91	0-4	B	16 568	1.04		0.02	0.01			0.05			Z	7016
	VITAL Survival Study - Kassena-Nankana		.5-7.5		21 906	0.70										1064
	VITAL Morbidity Survey Kassena-Nankana	1991			1177	1.50						0.20				7016
GUINEA	North Guinee - pregnant females	N.S.	pregnant	F	N.S.			5.20							Z	1040
	- lactating females		lactaring		N.S.			3.60								
KENYA	National Data	1976-81	N.S.	B	13 781		0.05	0.21	0.00	0.00	0.00	0.09	0.00	0.26	C	1039
	Baringo - Highland Tribe				702		0.00	1.13	0.00	0.00	0.00	0.00	0.00	1.13		
	- Lowland Tugen				472		0.21	0.36	0.00	0.00	0.00	0.21	0.00	0.57		
	- Njemps				590		0.00	0.00	0.00	0.00	0.00	1.01	0.00	0.00		
	- Pokot				595		0.33	0.84	0.00	0.00	0.00	0.33		1.17		
	Kajiado - Maasai Tribe				1920		0.00	0.05	0.00	0.00	0.00	0.16	0.00	0.05		
	Kakamega - Abaluhya				1649		0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.06		
	Kisii - Kisii Tribe				1753		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	Kwale - Giriama Tribe				1339		0.07	0.22	0.00	0.00	0.00	0.00	0.00	0.29		
	Meru - Meru Tribe				1137		0.11	0.61	0.00	0.00	0.00	0.00	0.00	0.72	Z	
	Nyanza - Luo Tribe				1807		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	Nyeri - Kikuyu				1817		0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.10		
LESOTHO	National Micron. Survey	1993	2-6	B	249			0.00						0.00	Z	1055
MALAWI	Lower Shire - dry season	1983	0-5.99	B	5436	3.39	0.09	0.33					0.05	3.86	A	1021
					5436	5.40	0.09	0.33					0.06	5.88		7004
				F	2818	3.40	0.10	0.21					0.07	3.80	Z	1021
				M	2597	3.41	0.07	0.46					0.04	4.05		
			0-.99	B	N.S.		0.00	0.00					0.00	0.00	A	
			1-1.99				0.00	0.10					0.10	0.20		
			2-2.99			3.50	0.00	0.21					0.00	3.71		
			3-3.99			4.56	0.20	0.41					0.10	5.27		
			4-4.99			7.15		0.20	0.74				0.06	7.41		
			N.S.											3.90	Z	1018
	Mbalachanda	7/88	0-4		2542	0.12	0.43			0.00				0.55		1033
	Salima and Dedza	9/88	2-7		650	1.40	0.50	0.20				0.00	0.00			7016
	Mkhota	3/89	0-8		3791	0.80	0.60	0.20	0.03			0.08	0.03	1.66		1033
MALI	Segou region	5-7/84	0-4		2000	0.10		0.20							Z	1022
	North-following severe drought	1985	children		734			3.54								
	Sikasso - rural		0-5.99		N.S.			0.50								7001
			6-10					0.00								
	- urban		0-5.99					0.00								
			6-10					0.50								
	Displaced population	4/86	0-5.99		195	7.64		0.00	0.00			0.51	0.51	8.15	B	7015
			6-10		104	10.58		0.96	0.00			1.92	0.00	11.54		
	Nomadic population		0-5.99		159	5.04		0.00	0.00			0.63	0.00	5.04		
			6-10		96	8.33		0.00	0.00			0.00	0.00	8.33		
	Sedentary population		0-5.99		884	6.41		0.00	0.00			0.34	0.00	6.41		
			6-10		337	9.50		0.00	0.00			1.48	0.00	9.50		
	Tomboctou and Segou		0-5.99		N.S.	6.45		0.00	0.00			0.40	0.08	6.53		
				F		6.51		0.00	0.00			0.32	0.00	6.51		
				M		6.22		0.00	0.00			0.49	0.16	6.38		
			6-10	B		9.48		0.19	0.00			1.30	0.00	9.67		
				F		7.84		0.00	0.00			0.37	0.00	7.84		
				M		11.24		0.37	0.00			2.25	0.00	11.61		
	Mourdiah: Nara	1989	5-14	B	478	6.69										7016
				F	208	2.90										
				M	270	9.60										
	Douen	1990	4-7	B		9.00		2.40				1.80			Z	7001
	Kolokani (NW Bamako)		2-10		162	4.90		1.20				1.80				1030
MAURITANIA	USAID survey	1983	< 5	B	N.S.									2.60	Z	1042
	Adar	1984	2-7											1.18		7001
	Nouakchott	1989	7-10											0.12		1042
		1990			3118									0.64		

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Country	Geographic area	Survey year	Age group	Sex	Sample size	Prevalence of ocular signs and symptoms XN	X1A	X1B	X2	X3A	X3B	XS	Corneal	Total	*	Ref. No.
MOZAMBIQUE	Zambezia Province	1987-88	children	B	3790	7.30					0.25	0.89				7001
	Maputo, Beira, Nampula	1990	.5-6.00		10 267	0.30		0.30				0.10		0.70		1075
NIGER	Tahoua, Maradi, and Zinder	5/1986	0-5.99	B	1388	3.97		0.72	0.07			0.22	0.14	4.83		7015
				F	N.S.	3.77		0.72	0.14			0.14	0.14	4.63		
				M		4.18		0.73	0.00			0.29	0.15	5.06		
			6-10	B	611	4.75		0.65	0.00			0.82	0.00	5.40		
				F		5.52		0.00	0.00			0.58	0.00	5.52		
				M		3.76		1.50	0.00			1.13	0.00	5.26		
	Maradi - rural		0-5	B	425	7.33		1.18	0.24			0.24	0.24	8.75		
			6-10		179	7.82		0.56	0.00			0.56	0.00	8.38		
	Tahoua - rural		0-5		386	3.11		0.52	0.00			0.52	0.26	3.89		
			6-10		213	5.16		0.94	0.00			0.47	0.00	6.10		
	Zinder - rural		0-5		422	3.21		0.47	0.00			0.00	0.00	3.68		
			6-10		169	1.78		0.00	0.00			1.78	0.00	1.78		
	Total rural		0-5		1233	3.08		0.73	0.08			0.24	0.16	3.97	B	
			6-10		561	4.99		0.53	0.00			0.89	0.00	5.52		
	Tahoua - urban		0-5		155	0.00		0.65	0.00			0.00	0.00	0.65		
			6-10		50	2.00		2.00	0.00			0.00	0.00	4.00		
	Goure	1986	0-5		430	1.20										
	National	1988	0-6		1504	2.01							0.81			7004
	Tillaberi Department	1990	0.5-6		2960	3.50	0.30	0.50				0.00	0.00			
			0-.99		243	0.80										
			1-1.99		385	1.30										
			2-2.99		475	2.90										
			3-3.99		437	4.30										
			4-4.99		343	6.70										
			5-5.99		367	6.00										
	- Filingue		0-5		703	1.80									Z	7016
	- Kollo				444	0.50										
	- Ouallam				481	6.90										
	- Say				297	0.30										
	- Tera				666	6.50										
	- Tillaberi				369	3.00										
NIGERIA	National	1994	0-5.99	B	2836	1.00		0.15	0.60	0.00	0.00	0.20			Z	1061
RWANDA	Sub-National - Gikongoro Prefecture	1987	0-6	B	5687			1.30				0.10	0.02		Z	7016
	Gikongoro:				454			0.88								
	Karama															
	Karambo				257			2.33								
	Kinyamakar				424			1.41								
	Kivu				556			2.88								
	Mubagu				438			1.14								
	Mudasomwa				710			0.84								
	Muko				608			1.97								
	Musange				415			0.96								
	Nshili				701			0.85								
	Nyamagabe				332			0.60								
	Rukondo				461			0.65								
	Rwamikowa				331			1.21								
SENEGAL	Casmance	11-12/79	all	B	1262							0.08			Z	7012
	Diourbel and Fatick - peanut growing	1988	2-6		865	14.10	2.70	0.20								7016
	Malicounda	2/1990	2-14		1259									0.00		1072
		2/1991			1008									0.00		
TOGO	Kara: Bassar	1992	0-4	B	N.S.	10.00									Z	7016
	Savanes: Dapaong					10.00										
UGANDA	Kamuli District - preliminary results	1991	0-6.00	B	5074	2.70		1.00				1.70	0.30	4.00	B	7004
	- dry season	10-11/91	0-5		5003	2.64		1.14				1.70	0.30	5.38		7023
			0-0.99		942									1.60	Z	1032
			1-1.99		765									1.20		
			2-2.99		773									2.30		
			3-3.99		871									4.00		
			4-4.99		751									5.90		
			5-5.99		901									8.40		
	- Budiope dry season		0-5		1325									6.60		
	- Bugabula dry season				1057									4.00		

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Country	Geographic area	Survey year	Age group	Sex	Sample size	Prevalence of ocular signs and symptoms										Ref. No.
						XN	X1A	X1B	X2	X3A	X3B	XS	Corneal	Total	*	
	- Bulamogi dry season				830									4.00		
	- Buzaaya dry season				1779									2.00		
UNITED REP. OF TANZANIA	Iringa	1974	0-4.99	B	N.S.		0.15	0.15	0.51			1.17	0.56	0.86	C	1024
	Mbeya, Iringa & Kagera	1982-85	0-5.99		12 980		0.21	0.10				0.85			Z	1014
			0-.99		2299		0.00	0.00				0.13				
			1		2999		0.13	0.03				0.20				
			2		3051		0.07	0.07				0.39				
			3		2675		0.34	0.04				0.41				
			4-5		1956		0.36	0.46				0.77				
	National - 11 Regions	1983-85	0-4		15 593		0.14	0.12	0.05			0.31				1025
	Biharamulo				2661		0.41	0.11	0.00			0.04				
	Iringa				1760		0.11	0.06	0.40			0.63				
	Igungu				735		0.00	0.54	0.00			0.14				
	Ludewa				1881		0.00	0.00	0.00			1.12				
	Mafinga				1180		0.25	0.00	0.00			1.27				
	Mbeya				188		0.00	0.00	0.00			0.00				
	Ngara				1776		0.34	0.11	0.00			0.00				
	Njombe				881		0.11	0.23	0.34			1.02				
	Nzega				2621		0.00	0.27	0.00			0.04				
	Tabora				1235		0.00	0.00	0.00			0.00				
	Urambo				675		0.00	0.00	0.00			0.00				
	8 regions	1984	0-10		7431	0.30		0.37					0.86	1.53	B	1024
	Arusha				1418	0.60		0.10					1.10	1.80		
	Bukoba				623	0.20		0.20					1.60	2.00		
	Dodoma				1690	0.30		0.90					0.80	2.00		
	Iringa				124	0.00		1.60					2.40	4.00		
	Mbeya				1317	0.00		0.00					0.00	0.00		
	Morogoro				233	0.00		0.00					3.00	3.00		
	Singida				908	0.00		0.20					1.30	1.50		
	Tanga				1118	0.40		0.50					0.20	1.10		
	Moshi				8106	0.20		0.20					0.90	1.30		
	Iringa	03-06/84	0-4		5975		0.08	0.07	0.12			1.15				1014
		11/84			1331		0.23	0.23	0.00			2.70				
	Tabora	03/85			5266		0.02	0.21				0.34				
				F	2501		0.04	0.00				0.24				
				M	2765		0.00	0.40				0.43				
	Iringa	04/85		B	1049		0.00	0.19	0.00			0.38				
	Kagera	07/85			4437		0.41	0.11	0.00			0.02				
	Lusu Ward: 4 villages in Nzega	2/86	children		2380			0.67								1027
	Tabora	02/86	0-4		3177			0.60				0.47				1014
				F	1522			0.39				0.46				
				M	1655			0.79				0.48				
ZAMBIA	3 districts: Luapula Province	8/85	0-5.99	B	4275	1.26		0.44	0.02			0.68		1.89	Z	1034
			0-0.49		373			0.00				0.00	0.00	0.00	D	
			0.5-0.99		347			0.00				0.58	0.00	0.00		
			1-1.99		782	1.17		0.26				0.26	0.13	1.56	B	
			2-3.99		1466	0.76		0.27				1.02	0.00	1.03		
			4-5.99		1307	1.86		0.99				0.77				
	Kawambwa District		0-5.99		647	1.84						0.62		1.86	Z	
	Mwense District				1086	0.71		0.09				0.55		1.11		
	Nchelenge District				2542	1.36		0.75				0.71	0.04	2.24		
	Ndola:	1988	0-4.99		423	1.40		0.70								7016
	Kansensi				133	0.00		0.00								
	Masala				97	1.00		2.10								
	Chipulukusu				113	0.90		0.00								
	Ndola - rural				80	5.00		1.30								
	Ndola - schools:		6-12		1164	1.89	0.00	1.80								
	Chibolele				309	2.00		1.20	0.00			0.00				
	Kabwata				146	6.50		3.40	0.00			0.00				
	Kansensi				232	0.30		0.30	0.00			0.00				
	Lumano				79	5.10		1.20	0.00			0.00				
	Ndola: Masala				398	1.20		2.40	0.00			0.00				
ZIMBABWE	Matableland- 6 districts	1991	children	B	6944	0.58		0.14					0.23		Z	1016
	Binga				1604	1.60		0.00					0.56			
	Bubi				626	0.00		0.32					0.00			
	Hwange				1249	0.56		0.40					0.00			
	Lupana				882	0.00		0.00					0.00			
	Nkayi				883	0.40		0.11					0.00			
	Tsholotsho				1700	0.24		0.12					0.40			

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Country	Geographic area	Survey year	Age group	Sex	Sample size	XN	X1A	X1B	X2	X3A	X3B	XS	Corneal	Total	*	Ref. No.
						Prevalence of ocular signs and symptoms										
REGION OF THE AMERICAS																
BOLIVIA	National - (INAN)	1981	.5-4.99	B	5745	1.10									Z	2016
	National - (PDRI)	1985	1-5		1088	2.30										
	La Paz : Iturralde	1986	0-4		1969	5.00										
	Inquisivi	1987	1-5		972	1.00										
BRAZIL	Coastal - total harvest	1981-1982	0-12	B	1440	0.00		0.07	0.00			0.00				2009
	Coastal Bayeux				689	0.00		0.00	0.00			0.00				
	Coastal Mamanguape - harvest				751	0.00		0.13	0.00			0.00				
	- inter-harvest		0-4		1011	0.00		0.00	0.00			0.00				
	Sertao - Conceicao harvest		0-12		1831	0.16		0.71	0.06			0.06				
	- Itaporanga harvest		0-4		917	0.22		0.44	0.00			0.00	0.00			
	- Itaporanga inter-harvest		school		649	0.15		0.31	0.00			0.15				
	- Itapuranga harvest		0-12		1566	0.13		0.38	0.00			0.06				
	- Pianco - harvest				1594	0.25		0.63	0.00			0.19				
	- Total harvest				4991	0.18		0.58	0.02			0.11				
			0-5.99		2802	0.18		0.28	0.00				0.11			
			6-12		2189	0.18		0.96	0.05			0.09				
	Transitional Esperanca - harvest		0-4		770	0.00		0.00	0.00				0.00			
	Transitional Esperanca - inter-harvest				720	0.00		0.13	0.00					0.00		
	Transitional-Esperanca - harvest		0-11		1431	0.00		0.00	0.00			0.00				
	Paraiba	1981-83	0-4.99		12 323	0.06		0.50				0.03				2002
	- Semi-arid				7070	0.07		0.78				0.06				
	- Litoral				1762	0.00		0.06				0.00				
	- Transitional				3491	0.06		0.17				0.00				
	Parelhas Jardin de Serito	1986	0-6		6291	0.01		0.60								2024
DOMINICAN REPUBLIC	Santa Domingo - hospital studies	1991	N.S.	B	820									2.80	Z	7010
EL SALVADOR	National	4/73	1-6	B	9508			0.05				0.03			Z	7011
GUATEMALA	Nebaj - Quiche	05/84	0-5	B	576		0.69					1.39				2004
	Rural	1986	0-10		1369									0.50	Z	7010
HAITI	National	1975	children	B	5589								2.50	8.00	Z	7002
SOUTH-EAST ASIA REGION																
BANGLADESH	Matlab - rural	1981	all	B	182 976	0.18		0.18				0.02	0.01	0.37	B	5032
				F	90 564	0.10		0.10				0.02	0.01	0.21		
				M	92 412	0.26		0.26				0.02	0.01	0.53		
			0-6.99	B	39 120	0.35		0.36				0.02	0.04	0.75		
				F	18 735	0.25		0.26				0.03	0.04	0.55		
				M	20 385	0.44		0.46				0.01	0.03	0.93		
			7-19.99	B	61 258	0.29		0.29				0.04	0.01	0.59		
				F	30 335	0.13		0.13				0.03	0.010	0.27		
				M	30 923	0.45		0.45				0.05	0.00	0.90		
	National	1982-83	.25-5.99	B	22 335	3.48	2.03	1.02	0.04			0.27	0.11	4.61		5057
	- rural				18 660	3.60	2.00	0.90	0.04			0.25	0.10	4.62		
	- urban				3675	2.80	2.50	1.60	0.05			0.35	0.16	4.54		
	Ranjpure District - baseline survey	1986	0-8.99		3040	3.55										5084
	- post intervention	1989			3389									1.74		
				F	1610									1.68		
				M	1779									1.80		
BHUTAN	National	1976	6-12	B	953									1.30	Z	5034
	Central Zone		all		200									2.50		5033
	Eastern Zone		6-12		151									2.20		5034
			all		201									1.50		5033
	Southern Zone		6-12		380									1.00		5034
			all		484									1.00		5033
	Western Zone		6-12		422									1.20		5034

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Country	Geographic area	Survey year	Age group	Sex	Sample size	XN	X1A	X1B	X2	X3A	X3B	XS	Corneal	Total	*	Ref. No.
					Prevalence of ocular signs and symptoms											
			all		475									1.10		5033
	National	1989	0-5		3273									0.70		
INDIA	Coimbatore District	N.S.	0-6	B	3907			9.80					0.07		Z	5058
	Assam		1-12		5039	5.22			0.04	0.06	0.00	0.15	0.10	11.27	A	5007
	- rural				2871	4.80			0.00	0.03	0.00	0.14	0.03	9.50		
	- tea garden colonies				1068	9.92			0.09	0.19	0.00	0.37	0.28	19.20		
	- urban				1100	1.81			0.90	0.00	0.00	0.00	0.90	8.27		
	7 villages in Madhya Pradesh: Jabalpur	< 1978	0-2.99		1000		24.10	7.50	1.10		0.20		1.30	32.90	C	5041
	9 states		1-5		N.S.									4.60	Z	
	Gujarat		pregnant	F										26.00		5045
			school	B		16.00								41.00		
	Orissa		1-5											12.80		5041
	Baroda City		5-15	M	1704	6.00	18.00	2.00						31.00		5044
	- underpriviledged															
	- one school		7-15	B	378	12.00	23.00	4.00						32.00		
	National - 10 states	1975	1-4.99		N.S.			0.60								5042
			5-12					1.70								
	NNMB Survey	1975-79	1-5					2.00								5043
	National - 10 states	1976	1-4.99					1.40								5042
			5-12					4.10								
		1977-78	1-4.99					1.40								
			5-12					4.20								
	9 States - Other villages	1977	0-4.99				13.30	4.90					0.60	18.80	C	5041
	- Tribal villages						12.60	4.20					0.20	17.00		
	Andhra Pradesh		1-5											4.40	Z	
	Gujarat													1.40		
	Karnataka													3.60		
	Kerala													0.70		
	Madhya Pradesh													8.70		
	Tamil Nadu													6.30		
	Uttar Pradesh													6.00		
	West Bengal													1.00		
	9 States - urban slums		0-4.99				17.60	1.80					1.20	20.60	C	
	National - 10 states	1979	1-4.99					0.90								5042
			5-12					1.30								
		1980	1-4.99					1.50								
			5-12					3.10								
		1981	1-4.99					2.70								
			5-12					5.10								
	Baroda City - underpriveledged		5-15			16.00	30.00	8.00						41.00		
				F										37.00	Z	
				M										45.00		
			5-9.99	B										33.00		
			10-15											49.00		5044
	Sevagram	1981-82	0-.99											0.00		5040
			0-5.99		1180	5.80	10.20	3.80						9.60		
				F	560	7.10	9.50	4.10						18.20		
				M	620	4.50	10.90	3.50						15.60		
			1-1.99	B	209									14.40		
				F	96									13.50		
				M	111									15.30		
			2-2.99	B	281									15.00		
				F	117									20.60		
				M	164									11.00		
			3-3.99	B	192									39.50		
				F	87									43.60		
				M	105									36.10		
			4-4.99		82									54.80		
			4-4.99	F	92									44.50		
	Andhra Pradesh	1982	0-4.99	B	N.S.			1.80								5042
	Gujarat							1.80								
	Karnataka							1.60								
	Kerala							0.00								
	Maharashtra							3.10								
	Orissa							0.80								
	Tamil Nadu							3.80								
	West Bengal							4.90								
	Gorakhpur	11/84			3710	2.35	0.65	0.86	0.08			0.46	0.08	3.75		5007
	Jodhpur				1877	3.62	8.84	6.82	0.05			0.80	0.10	11.29		
	Ranchi				3959	4.98	8.26	2.98	0.03			0.28	0.13	8.17		
	Calcutta				3905	4.05	5.99	3.12	0.18			0.18	0.05			
	Baroda Survey - Chandrapur and Panchmahal	1986-87	0-6		4032	0.50	5.70	3.30					0.50			5085

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Country	Geographic area	Survey year	Age group	Sex	Sample size	XN	X1A	X1B	X2	X3A	X3B	XS	Corneal	Total	*	Ref. No.
						Prevalence of ocular signs and symptoms										
			0-1		N.S.	0.10	0.90	0.70					1.01			
			1-2			0.50	5.00	1.20								
			2-3			0.70	5.90	3.90					0.70			
			3-4			0.70	8.80	3.60					0.40			
			4-5			0.60	6.80	5.40					0.50			
			5-6			0.40	8.10	7.30					1.50			
	Kashi Block, Varanasi	1987	0-5		2304	6.80	12.10	8.20	0.20			0.70	0.54	15.90	A	5038
	- total															
	- PEM1&2				1406	7.70	13.10	9.00	0.10			0.90	0.60	17.7		
	- PEM3&4				239	9.60	18.00	10.00	1.70			0.40	2.50	21.7		
	- no morbidity				1706	1.40	9.00	0.90	0.00			0.50	0.00	11.30		
	- with diarrhea				232	29.30	15.90	36.30				0.90	4.30	85.80		
	- ARI				24	33.30	8.30	50.00					12.50	99.98		
	- with worms				260	25.40	28.10	34.60				1.20	1.60	89.70		
	- normal nutrit. status				659	3.90	7.80	5.60	0.00				0.00	17.30		
	Gorakhpur - slums		0-6		1376	0.58	9.18	1.70	0.29			0.07	0.36	11.82	A	5036
	- initial survey															
	- 6 months later				1379	0.29	7.21	1.20	0.14			0.07	0.21	8.91		
	Andhra Pradesh, 5 health centers	1987-89	1-5		15 775			6.00								5037
	- baseline															
	- after treatment				7691			1.30								
	- control				8084			2.90								
	NNMB survey	1988-90	0-5		N.S.			0.70								5043
	Southern India	1989	0-4.99											11.00		7003
	Tamil Nadu- drought prone		.6-4.99		15 419	3.70		7.20				0.07	0.05	10.95	B	5035
	Chandrapur: Maharashtra	3-7/91	0-6		N.S.									0.99	Z	5064
	Panchmahal: Gujarat													3.50		
INDONESIA	Central Java - plateau	07-08/73	1-4.99	B	2812		3.06	4.23							Z	5074
	Central Java - plateau				1374		5.17	4.80								
	- rural															
	- urban				1438		1.04	3.69								
	Medan town	11/74	0-5	F	360		1.00									5046
				M			1.10									
	4 villages - N. Sumatra		0-6	B	1017		16.80	0.70				1.10	0.40	17.90	C	
				F	489		11.50	0.60				1.00	0.60	12.70		
				M	528		21.70	0.80				1.10	0.20	22.70		
			0-0.99	B	207		5.80	0.00				0.50	1.00	6.80		
				F	108		3.70	0.00				0.90	0.90	4.60		
				M	91		8.80	0.00				0.00	1.10	9.90	C	
			1-3.99	B	328		13.40	0.30				1.20	0.60	14.30		
				F	158		8.89	0.60				1.30	1.30	10.80		
				M	170		17.60	0.00				1.18	0.00	17.64		
			4-5.99	B	490		23.50	1.29				1.22	0.00	24.70		
				F	223		17.00	0.90				0.90	0.00	17.90	C	
				M	267		28.80	1.50				1.50	0.00	30.30		
	National	1977-78	0-5.99	B	35 274			1.01				0.13	0.06			5017
			1		5677			0.44								
			2		5857			1.20								
			3		5972			1.57								
			4		5475			1.28								
			5		6027			1.53								
	Aceh	1977	0-4.99		N.S.			2.42					0.48	2.90	D	5047
	Bali							0.76					0.08	0.84		
	Bengkulu							0.65					0.22	0.87		
	Central Java							1.11					0.04	1.15		
	Central Kalimantan							1.50					0.11	1.61		
	Central Sulawesi							1.05					0.00	1.05		
	East Java							0.75					0.00	0.75		
	East Kalimantan							0.00					0.00	0.00		
	Jakarta							0.73					0.00	0.73		
	Jambi							0.91					0.00	0.91		
	Lampung							0.20					0.00	0.20		
	Maluku							2.04					0.00	0.00	Z	
	North Sulawesi							0.40					0.00	0.40	D	
	North Sumatra							0.43					0.00	0.43		
	Riau							0.43					0.00	0.43		
	South Kalimantan							1.47					0.00	1.47		
	South Sulawesi							0.40					0.08	0.48		
	South Sumatra							0.33					0.17	1.65		
	Southeast Sulawesi							0.49					0.00	0.00	Z	
	West Java							1.55					0.10	1.65	D	
	West Kalimantan							0.43					0.00	0.43		
	West Nusa Tenggara							1.57					0.21	1.78		

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Country	Geographic area	Survey year	Age group	Sex	Sample size	Prevalence of ocular signs and symptoms XN	X1A	X1B	X2	X3A	X3B	XS	Corneal	Total	*	Ref. No.
	West Sumatra							1.31					0.16	1.47		
	Lombok - pre program		0.5-5			2.80		1.60				0.22	0.22			5048
	Lombok - post program	1983				0.90		0.24				0.20	0.04			
	Aceh - Baseline data	1982-83	0-5.99		24 986	1.17		1.23								5021
			0-0.99		3867	0.00		0.10								
			1		3841	0.29		0.44								
			2		4148	1.35		1.16								
			3		4294	1.82		1.84								
			4		3617	1.74		1.80								
			5		5203	1.61		1.83								
	West Java	1984			N.S.			0.14					0.00	0.14		5047
	Bogor	1985			2169		0.60	0.83								5016
	- control-baseline															
	- study-baseline				2102		0.38	1.24								
	- control-6 month				2169		0.78	0.92								
	- study-6 month				2102		0.33	0.33								
	- control-12 month				2169		0.65		1.11							
	- study-12 month				2102		0.29	0.19								
	Central Java				N.S.			0.91					0.00	0.91		5047
	South Sulawesi	1986						0.26					0.00	0.26		
	West Nusa Tenggara							0.24					0.04	0.28		
	Aceh	1989	N.S.					1.28					0.10	1.38		7008
	Central Java							0.91					0.00	0.91		
	Nusa Tenggara							0.24					0.04	0.28		
	South Sulawesi							0.26					0.00	0.26		
	4 Provinces:	1991	0-4		21 660			0.14					0.03			5047
	East Nusa Tengarra				5163			0.00					0.00	0.00		
	East Timor				5163			0.27					0.14	0.27		
	Irian Jaya				4339			0.25						0.00	Z	
	Maluku				6798			0.10					0.00	0.00		
MYANMAR	Natogyi (townships)	1978-90	0-4.99	B	13 771			0.73							Z	5063
	- Saku				150			3.33								
	- Thazi				5356			0.93								
	- Wetlet				15 322			1.13								
	6 townships	1982-85			49 263			1.00								5051
	4 regions:	1987-89	2-14		1862			3.38								5063
			2-5.99		642			2.02								
			6-9.99		687			4.51								
			10-14		533			3.57								
	Hinthada		2-5.99		199			0.50								
			6-9.99		196			1.53								
			10-14		186			1.61								
	Kyaukpadaung		2-5.99		185			4.32								
			6-9.99		137			6.57								
			10-14		158			3.80								
	Monywa		2-5.99		114			2.63								
			6-9.99		223			8.52								
			10-14		87			9.30								
	Taunggyi		2-5.99		144			0.69								
			6-9.99		131			0.00								
			10-14		102			1.96								
	Myin Gyan	1990	0-4.99		6030			1.21								5051
	Nyaung Oo				1917			1.62								
	Pakokku				6551			0.50								
NEPAL	Baglung	1979	0-5	B	1489	1.00								1.00	Z	5068
	National	1979-80			7201			0.60						0.90		5065
				M	3632			0.70						1.10		
				F	3569			0.50						0.60		
	- urban			B	367			0.60						0.80		
	- rural				6837			0.60						0.90		
	- central				2189			0.80						1.20		
	- eastern				1833			0.80						0.90		
	- far west A				147			0.30						0.50		
	- far west B				790			0.60						0.90		
	- hills				3326			0.30						0.40		
	- mountains				258			0.00						0.00		
	- terai				3315			1.00						1.40		
	- valleys				305			0.00						0.00		
	- western				1345			0.30						0.40		
	Bagmati				666			0.20						0.30		
	Bheri				622			0.00						0.10		
	Dhaulagiri				91			0.00						0.00		

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Country	Geographic area	Survey year	Age group	Sex	Sample size	Prevalence of ocular signs and symptoms XN	X1A	X1B	X2	X3A	X3B	XS	Corneal	Total	*	Ref. No.
	Gandaki				561			0.30						0.70		
	Janakpur				686			0.70						0.70		
	Karnali				73			0.00						0.00		
	Koshi				669			0.30						0.50		
	Lumbini				693			0.30						0.30		
	Mahakali				450			0.80						1.30		
	Mechi				473			0.40						0.40		
	Naryani				837			1.50						2.20		
	Rapti				352			0.80						1.10		
	Sagarnatha				691			1.40						1.70		
	Seti				340			0.30						0.30		
	National	1981	0-14		6118	1.10		1.65				0.03	0.02			7005
			0-6		7580			0.64				0.20				
	Baglung	1985			478									1.70		5068
	Surkhet		0-4		1106	1.00										
	Lahan Eye Hospital	1986-88	0-10		4601				1.69			3.45		10.16	C	5086
				F	1793				1.56			4.41		10.32		
				M	2808				1.78			2.85		10.18		
			0-5	F	909				2.75			6.82		16.94		
				M	1285				3.50			4.82		17.89		
			6-10	F	884				0.34			1.92		3.50		
				M	1523				0.33			1.18		3.68		
	West Central Terai	1988	children	B	17 000									1.70	Z	7005
	Central Terai - Bara		0-10		8682			2.00								
	- Parsa				8402			2.60								
	East Central Terai - Sarlahi		0.5-4		3895								0.05	3.05		
	Jumla	1990	0-4		3651									13.20		5059
	3 Terai Districts	1992	0-10		N.S.									4.10		5080
	FarWest Hill - Doti (20 clusters)	06-09\93	.5-5		1342			3.60								
	FarWest Terai - Kailali (20 clusters)				2116			2.20								
	FarWest Terai - Kanchanpur				1889			1.50								
	MidWest Mt.- Dolpa (20 clusters)				1245			4.30								
	MidWest Terai - Bardiya (20 clusters)				2206			3.30								
SRI LANKA	National	1975-76	.5-5.99	B	13 450			1.10							Z	5054
			.5-.99		1230			0.10								
			1		2598			0.20								
			2		2425	0.60		0.80								
			2-5.99		9536	1.00										
			3		2511	1.40		1.40								
			4		2503	0.90		1.40								
			5		2183	1.40		2.10								
	Amparai	1980-82	N.S.	F	N.S.	2.70		1.60			0.20	0.20				5062
				M		2.40		2.30			0.00	0.00				
	Anuradhapura			F		1.60		1.90			0.00	0.10				
				M		1.00		1.00			0.10	0.30				
	Badulla			F		0.40		0.40			0.00	0.10				
				M		0.70		1.10			0.00	0.00				
	Batticaloa			F		2.20		1.70			0.00	0.30				
				M		1.70		2.30			0.00	0.00				
	Columbo			F		0.30		0.70			0.00	0.00				
				M		0.10		0.80			0.00	0.10				
	Galle			F		5.20		8.70			0.00	0.20				
				M		2.60		7.60			0.00	0.00				
	Gampaha			F		1.10		1.20			0.30	0.10				
				M		0.60		1.70			0.30	0.00				
	Hambantota			F		0.50										
				M		1.40		2.30								
	Jaffna			F		0.60		2.50			0.00	0.50				
				M		0.70		2.90			0.10	0.20				
	Kalutara			F		2.10		0.90			0.00	0.20				
				M		1.50		0.40			0.00	0.20				
	Kandy			F		1.50		2.50			0.10	0.20				
				M		1.00		3.50			0.20	0.10				
	Kegalle			F		0.50		3.40			0.10	0.00				
				M		0.30		3.80			0.00	0.00				
	Kurunegala			F		0.20		0.20			0.00	0.00				
				M		0.20		0.80			0.10	0.10				
	Mannar			F		4.10		0.40			1.80	0.40				
				M		1.80		0.60			1.00	0.40				

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Country	Geographic area	Survey year	Age group	Sex	Sample size	Prevalence of ocular signs and symptoms XN	X1A	X1B	X2	X3A	X3B	XS	Corneal	Total	*	Ref. No.
	Matale			F		0.20		0.00			0.20	0.00				
				M		0.00		0.50			0.00	0.00				
	Matara			F		0.30		0.30								
				M				1.90								
	Moneragala			F				0.50			0.00	0.30				
				M				0.00			0.00	0.20				
	Mullaittivu			F		1.10		0.20			0.00	0.00				
				M		0.50		0.90			0.00	0.20				
	Nuwara Eliya			F				0.20			0.00	0.20				
				M		0.20		0.50			0.00	0.00				
	Polonnaruwa			F		0.70		0.60			0.00	0.00				
				M		0.70		0.80			0.10	0.10				
	Puttalam			F		0.00		0.00			0.00	0.00				
				M		0.00		0.30			0.00	0.00				
	Ratnapura			F		0.90		0.30			0.10	0.00				
				M		0.80		0.80			0.00	0.10				
	Trincomalee			F		2.20		5.10			0.20	0.00				
				M		1.50		5.10			0.30	0.10				
	Vavuniya			F				0.00			0.00	0.00				
				M				0.00			0.00	0.00				
	Columbo	1981	school	B	3973		0.40	0.20								
		1982			7198		8.30	1.20								
		1983			5522		2.40	0.20								
		1984			2546		6.50	0.00								
		1985			4210		5.20	0.10								
	National	1987	0-4		32 643	0.26	0.94	0.33								5026
			school		25 772	1.11	0.49	1.23								
	Anuradhapura		0-4		3008	0.00	0.37	0.60								
	Jaffna				6700	0.06	0.06	0.00								
	Kalutara				4330	0.53	0.92	0.09								
	Kandy				8917	0.37	0.79	0.07								
	Kegalle				1245	0.08	2.33	0.64								
	Kurunegala				5545	0.41	2.33	0.81								
	Matale				1655	0.00	1.45	1.09								
	Puttalam				1243	0.00	0.00	0.64								
THAILAND	Sakon Nakhon	05-06/85	3-7.99	B	271	0.00	3.90	0.00								
	- urban		3-3.99		51	0.00	6.50	0.00							Z	5029
			4-4.99		56	0.00	0.00	0.00								
			5-5.99		37	0.00	6.40	0.00								
			6-6.99		58	0.00										
			7-7.99		69	0.00										
	- rural		1-7.99		1373	1.30	16.20	0.40								
			1-1.99		82	1.20	5.30	0.00								
			2-2.99		77	2.60	6.60	0.00								
			3-3.99		204	1.00	9.20	0.50								
			4-4.99		237	1.30	14.30	0.40								
			5-5.99		206	1.00	24.70	0.50								
			6-6.99		275	2.20										
			7-7.99		292	0.70										
	Sakon Nakhon, NE	1987	2-6		806	1.30		0.40								7005
	North and Northeast - dry season	1990			996			1.00								
	North and Northeast Thailand	2-3/90			491	3.10										5070
		9-10/90			N.S.	2.20										
	South - 5 provinces	1992			444							0.900	0.670			7005
EASTERN MEDITERRANEAN REGION																
AFGHANISTAN	Kabul	1989	5-14	B	N.S.		2.40								Z	3017
			<5				0.00									
DJIBOUTI	Rural	2/88	0-5	B	385	0.26		1.04				0.80			Z	3013
	Urban				235	0.00		0.43				0.43				
IRAQ	Hartha - rapid assessment	05/91	1-6	B	231	2.90		1.40							Z	3021
	Baghdad, Basrah, Mosul: health centres - (preliminary data only)	1994	0-4.99		7000	1.60								2.10	A	3026
MOROCCO	National	1971	0-3.99	B	6710									1.00	Z	3008
OMAN	12 MCH centres	1981	0-6	B	566		5.30	1.50							Z	3019
				F	172		1.10	1.10								
				M	394		7.10	1.70								
	N.S.	1991	0-2	B	N.S.									0.00		3005

* Total xerophthalmia rate: 'A' = XN-X3B, 'B' = XN-X3B, no X1A, 'C' = X1A-X3B, 'D' = X1B-X3B, 'Z' = Not specified

Country	Geographic area	Survey year	Age group	Sex	Sample size	XN	X1A	X1B	X2	X3A	X3B	XS	Corneal	Total	*	Ref. No.
						Prevalence of ocular signs and symptoms										
PAKISTAN	National micronutrient survey	1976-77	0-4.99	B	N.S.			1.50							Z	3003
	Karachi	1976-79	0-3		110		2.73	0.00								
				F	57		1.75	0.00								
				M	53		3.77	0.00								
			4-15	B	385		26.23	1.82								
				F	212		17.45	1.42								
				M	173		36.99	2.31								
	Orangi, Al Fateh	1987	5-15	B	106		22.00	3.80								3014
	Thar Desert - drought		N.S.		N.S.	7.00										3006
	Karachi - 3 urban slums	2-3/90	.5-4.99		578									0.00		3027
SUDAN	Red Sea: Kassala	1980	0-6		1555		13.70		0.06					2.70	Z	3018
				M	814		15.60		0.12					3.56		
				F	741		11.61		0.00					1.75		
	Sinkat West: Red Sea Province		0-15	B	100		12.00	8.00				0.00	0.00	20.00	C	
	Wad Kowli refugee camp	1985	children		104		5.70	10.60				2.90	1.00	17.30		3011
	Gebeit Elma'adin: Red Sea Provence	5/85	0-15		64		4.70	0.00				0.00	0.00	4.70		
	Muhammad Qod: Red Sea Provence				67		10.40	3.00				1.50	0.00	13.40		
	Omduran camp-Kordofan Province		0-15		124		12.10	3.20				0.00	0.00	15.30		
	Quirba Central - health workers		N.S.	F	14		28.57	14.29				0.00	0.00	42.86		
	- lactating with therapeutic feeding		lactating		17		11.76	5.88				23.53	0.00	17.64		
	- lactating, gen. population				46		4.35	17.39				2.17	0.00	21.74		
	- program, gen. population		pregnant		5		0.00	60.00				0.00	0.00	60.00		
	Wad Sherife camp - supplementary feeding	1985-86	0-15	B	100		9.00	5.00				2.00	1.00	15.00		
	- therapeutic feeding				115		13.00	4.30				0.00	0.00	17.30		
	- totals				215		11.20	4.70				0.90	0.50	16.40		
	Aserni: Abetchi Bergu Tribe - outside camp	6/85			28		10.71	3.57				3.57	0.00	14.28		
	- inside camp				43		9.30	0.00				6.980	0.00	9.30		
	Aserni camp-Dudjo Tribe				45		8.88	0.00				0.00	2.20	11.10		
	Aserni camp-nomad Zagat Arabs				42		7.14	0.00				0.00	0.00	7.14		
	Fau refugee camp - supplementary feeding				88		5.70	11.40				2.30	4.50	21.60		
	- therapeutic feeding				44		0.00	4.55				2.27	0.00	4.55		
	Blue Nile	1986-87	0-5		N.S.	1.60										3015
	Gezira					0.40										
	Kassala					0.50										
	Khartoum					2.10										
	N. Darfur					3.50										
	N. Kordofan					5.60										
	Nile					0.70										
	Northern					0.50										
	Red Sea					1.30										
	S. Darfur					4.50										
	S. Kordofan					1.60										
	White Nile					1.10										
	North Darfur:	1988	<6		1919	0.52		0.10				0.10				3010
	Farig				21	0.00		4.80				0.00	0.00	4.80	B	3022
	Heilat Salih				434	0.20									Z	
	Humaida				88	0.00										
	Imtidad				103	0.00										
	Kheir Wagid				295	0.30										
	Oordi				126	0.00										
	Rumalia				302	0.30										
	Sanger, Dulal, Kurge				288	1.70										
	Shag Zaroog				205	1.00										
	Tosal				70	0.00										
	Rural				1787	0.60		0.00				0.34	0.06	0.66	B	
	Urban				103	0.00		0.00				0.97	0.00	0.00		
	Khartoum & Gezera Province - rural	1988-90	0.75-6		30 000	3.30		3.30								7004

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Country	Geographic area	Survey year	Age group	Sex	Sample size	Prevalence of ocular signs and symptoms XN	X1A	X1B	X2	X3A	X3B	XS	Corneal	Total	*	Ref. No.
	Derudah	10-12/89	0.5-6		158									0.00	Z	3024
	Halayib				218									0.00		
	N. Tokar				272									6.20		
	Red Sea Province		<6		2001	1.10		0.70				0.05		1.60		
			0-0.99		332									0.30		
			1-1.99		276									1.10		
			2-2.99		403									1.50		
			3-3.99		302									1.70		
			4-4.99		281									3.20		
	Rural Port Sudan		<6		144									2.10		
	Rural Red Sea				1207									2.50		
	South Tokar				259									0.00		
	Sinkat				156									6.40		
	Urban Port Sudan				194									0.00		
	- A															
	- B				197									1.50		
	- C				204									0.00		
	- D				199									0.00		
	Urban Red Sea				794									0.40		
YEMEN	6 health centres	1981	0-5.99	B	322				0.00	0.00	0.00					3012
			6-14		267	1.12	10.00	4.00				0.37				
	Tihama region - 21 villages (preliminary)	5-6/92	1-6		2470	0.40		1.70				0.04	0.04	2.14	B	3020
				F	1148	0.2		1.22				0.09	0.00	1.42		
				M	1322	0.53		2.11				0.00	0.08	2.72		
			2-2.99	B	447	0.00		1.6				0.22	0.00	1.60		
			3-3.99		500	0.40		1.40				0.00	0.20	2.00		
			4-4.99		468	0.43		2.13				0.00	0.00	2.56		
			5-5.99		611	0.82		2.94				0.00	0.00	3.76		
WESTERN PACIFIC REGION																
CAMBODIA	5 provinces	1993	1-6	B	10 107	6.30		0.60	0.03			0.07			Z	6020
	Takeo				2000	11.00	0.60	0.50	0.05			0.01				
	Rattanakiri	06/93			1607	2.05	0.50	0.93	0.06			0.00				
	Koh Kong	07/93			2150	5.30		0.74	0.00			0.05				
	Kompong Thom				2288	9.80		0.69	0.04			0.05				
	Phnom Penh				2062	2.08		0.00	0.00			0.10				
COOK ISLANDS	High-risk malnut. areas	1989-92	.5-6	B										0.00	Z	7022
KIRIBATI	Bonriki village	1989	<7	B	150	12.00	18.00	4.00							Z	6019
	Tabiang village				80	24.00	9.00	11.00								
	Taraw and Abemama Atoll				230	16.00	15.00	7.00								
	National - 6 islands	9-10/89	0.5-5		4614	3.52		10.85	0.32	0.04		1.08		14.74	B	6013
				F	2169	3.50		9.00	0.10	0.00		0.80		12.60		
				M	2445	3.60		12.50	0.50	0.10		1.40		16.60		
	Abemama Island			B	321	8.40		13.70	1.60	0.00		1.90		23.60		
	Butaritari Island				640	0.60		2.80	0.00	0.00		0.00		3.40		
	Nonouti Island				492	7.70		10.80	0.60	0.00		2.40		19.10		
	South Tarawa Island				1894	3.20		10.80	0.30	0.10		1.10		14.40		
	Tabiteuea North Island				594	4.00		15.20	0.20	0.20		1.90		19.50		
	Abaiang Island				686	1.30		13.50	0.00	0.00		0.20		14.80		
	Kiritimati Island - 3 villages	1994	0-6		357									1.12		6023
	Banana village				106		2.83									
	Tabakea				117		0.85									
	London				134		0.00									
LAO P.D.R.	Mekong Valley	1968-69	N.S.	B	2988									7.62	Z	7005
	National	1995	2-5.99	B		0.70										6026
MALAYSIA	Iban-Sut and Mujong River	1976-78	0-6	B	414									20.50	Z	6006
	Iban - Lemanak River				388									12.90		
	Iban - middle Mukah River				460									3.90		
	Kayan and Kenyah - Baram River				556									11.50		
	Land Dayak-Tebakang				552									6.90		
	Malay - Sarawak River Delta				361									38.20		
	Melanau - Tillian River 3rd				352									2.00		

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Country	Geographic area	Survey year	Age group	Sex	Sample size	Prevalence of ocular signs and symptoms										Ref. No.
						XN	X1A	X1B	X2	X3A	X3B	XS	Corneal	Total	*	
	Penan - Mulu area				131									19.10		
	Sungai Choh	1977	0-4.99		651									1.60	B	
			adults		202									5.50	Z	
			school		251									10.80		
MARSHALL ISLANDS	National Nutrition Survey	1990-91	<7	B	N.S.	2.00		4.00				1.00	3.00			6029
MICRONESIA (FED. STATES OF)	National - Chuuk	12/88-5/89	3-6.99	B	448	14.00		6.00							Z	6017
				F	227	11.00		4.00								
				M	221	16.00		8.00								
PAPUA NEW GUINEA	9 provinces - hospitals	4-6/1993	.5-5.99	B	1027	0.39		0.19					0.00	0.59	Z	7023
PHILIPPINES	Cebu	1976	N.S	B	N.S.									4.50	Z	7003
	Metro Manila	1976-82	N.S.											3.90		
	Cebu and Marinduque	1979-81												4.40		
	National	1982	2-6		2621	1.80		1.40						3.50		6022
		1987	.5-6		3389	0.70		0.20				0.10	0.00	0.90		
	Antique		N.S.		N.S.	2.40		0.80						4.00		
	Las Pinas				N.S.	1.20		2.10						3.60		
	Antique	1989	0-5.99		4948	0.80		0.20					0.04	1.04	B	7005
	N. Samar	1991	N.S.		3127	4.40		2.70					0.20	7.30		
	Quezon		0-5.99		3404	1.60		0.60					0.00	2.20		
	Zamboanga		N.S.		4847	1.50		2.00					0.10	3.60		
	National nutrition survey	1993	.5-6	B	5049	0.40		0.10								6024
			7-14		4578	1.30		0.10				0.20				
			15-19		1593	1.10		0.20				0.20				
			pregnant	F	783	0.50										
			lactating		1053	1.00		0.00								
			all	B	13 056	0.80		0.10				0.10				
	- urban				11 987	1.30		0.20				0.30				
	- rural				9647	0.90		0.10				0.40				
SOLOMON ISLANDS	Gizo Island	11-12/91	.5-6	B	273									2.20	Z	6014
	Guadalcanal				339									0.60		
	Kolombangara				106									5.70		
	Malaita				1495									1.50		
	Marovo Lagoon				246									1.20		
	Vella Lavella				342									0.30		
	Vonavona Lagoon				95									5.30		
	7 islands		.5-5.99		2896	0.52		1.42				0.00	0.07	1.52	B	
			1-1.99		N.S.									0.60	Z	
			2-2.99											0.80		
			3-3.99											1.30		
			4-4.99											3.90		
			5-5.99											20.80		
TUVALU	National	1991	.5-6	B	1059	0.00		0.00				0.00		0.00	Z	6025
VANUATU	National	1991	<5	B	1870								0.05		Z	7023
VIET NAM	creches,kinderg,orphans, general population	1984	0-5	B	1700								0.65	4.20	Z	6010
	National	1985-87	0-4.99		34 214	0.37		0.16				0.12	0.07	0.60	B	6016
			4-4.99		5038	0.67		0.22					0.00	0.89		6011
	National (totals)		0-4.99		21 337	0.29		0.12				0.12	0.07	0.48		
				F	10 734	0.18		0.08				0.14	0.06			
				M	10 643	0.39		0.16				0.10	0.08			
	Dac Lac		0-4.99	B	501	0.19		0.40				0.00	0.00	0.59		
	Ha Nam Ninh				3147	0.25		0.06				0.19	0.13	0.44		
	Ha Son Binh				1286	0.15		0.00				0.08	0.78	0.23		
	Hai Phong				557	0.00		0.00				0.00	0.00	0.00		
	Hanoi				7886	0.34		0.16				0.11	0.76	0.58		
	Kien Giang				749	0.27		0.40				0.00	0.00	0.67		
	Long an				651	0.31		0.00				0.00	0.15	0.46		
	Minh Hai				621	0.32		0.32				0.48	0.00	0.64		
	Nghe Tinh				1144	0.26		0.00				0.09	0.09	0.35		
	Thanh Hoa				3092	0.23		0.00				0.03	0.06	0.29		
	Vinh Phu				1723	0.46		0.23				0.29	0.06	0.75		
	Central Highlands	1985-89			2455	0.48		0.28				0.24	0.00	0.76		6016
	Central Vietnam	1985-88			501	0.40		0.40				0.00	0.00	0.80		6011
	- High Plateau															
	- North				4236	0.43		0.00				0.02	0.07	0.52		
	- South Coast				2405	0.91		0.41				0.16	0.12	1.44		

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Country	Geographic area	Survey year	Age group	Sex	Sample size	Prevalence of ocular signs and symptoms										Ref. No.
						XN	X1A	X1B	X2	X3A	X3B	XS	Corneal	Total	*	
	Hanoi City	1985-89			1180	0.17		0.00				0.17	0.00	0.17		6016
	Ho Chi Minh City				2514	0.36		0.13				0.27	0.13	0.62		
	Mekong River Delta				2021	0.34		0.25				0.15	0.05	0.64		
	Midlands				1723	0.58		0.22				0.30	0.06	0.86		
	Mountains				5149	0.27		0.14				0.09	0.04	0.45		
	North of Central Coast				4236	0.43		0.00				0.02	0.07	0.50		
	Red River Delta				11 716	0.43		0.13				0.12	0.09	0.65		
	South of Central Coast				5734	0.78		0.31				0.08	0.07	1.16		
	National	10/88	0-4.99		23 782	0.35	0.15	0.15				0.13			A	6015
				F	11 930	0.27	0.13	0.10				0.13	0.07	0.57		
				M	11 852	0.44	0.17	0.20				0.12	0.09	0.90		
			0-0.99	B	3938								0.05	0.13		
			1-1.99		5470	0.05	0.00	0.00	0.00				0.09	0.43		
			2-2.99		4872	0.51							0.16	1.00		
			3-3.99		4844	0.60							0.08	1.13		
			4-4.99		4685	0.58								0.90		
		1994	<5	B	37 920	0.05		0.04				0.05	0.01	0.14		6027

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Prevalence of Serum Retinol Levels Suggestive of a Significant Public Health Problem

- Disaggregated Tables -

Country	Geographic Area	Survey year	Age group	Sex	Sample size	Indicators of Vitamin A Deficiency - Serum Vitamin A					Ref. no.
						Vitamin A Levels (umol/l)					
						*	< 0.35	< 0.70	Mean	S.D.	
AFRICAN REGION											
BURKINA FASO	Upper Volta	03-04/78	0-5.99	B	17	Z	17.6	70.5	0.58	0.25	7012
			6-14		178		7.3	66.2	0.61	0.23	
			pregnant		78		6.4	57.6	0.70	0.33	
CAMEROON	8 villages: Kaele Dept. (N. Province)	1988	.25-1.00	B	N.S.	Z	50.0				7001
	Extreme northern province		1-1.99					19.0			1049
			2-2.99					40.0			
			3-3.99					19.0			
			4-4.99					11.0			
	Periurban	4-5/1992	N.S.		95		1.1	17.9			7023
	Flooded plains				52		1.9	23.1			
	Periurban and flooded plains - total				147		1.3	19.7			
	Bulu du Dja Canton	1993	children		N.S.		0.00	17.2			
CAPE VERDE	San Vicente and Fogo	1983	7-12.99	B	254	Z	6.7				7016
			13-19		247		7.3				
CONGO	Brazzaville - past history of malaria	1988	.5-6.99	B	68	Z	0.0	38.2	0.99	0.52	1070
	- no history of malaria				52		1.9	15.4	1.10	0.50	
	- malaria at time of survey				48		37.5	83.3	0.52	0.33	
CÔTE D'IVOIRE	Dabakala, Boniérédougou & Foumbolo	11-12/88	1-3.99	B	151	A	25.0	68.0			1059
	- malnourished				96		31.3	68.8			
	- well nourished				55		14.5	67.2			
	NW: Odienne, Touba, Seguela & Mankono - after supplementation (Preliminary study)	3-11/94	.5-4.99		342	Z	12.3	36.6			1063
					170			54.4			
					172			45.6			
			.5-.99		N.S.			44.0			
			1-1.99					43.7			
			2-2.99					32.9			
			3-3.99					43.4			
			4-4.99					27.3			
ETHIOPIA	National	1980-81	0.5-5.99	B	739	Z	16.4	59.6	0.62		1052
				F	301				0.62		
				M	438				0.62		
			.5-.99	F	22				0.62		
				M	17				0.62		
			1-1.99	F	35				0.59		
				M	42				0.69		
			2-2.99	F	41				0.71		
				M	46				0.66		
			3-3.99	F	55				0.56		
				M	85				0.63		
			4-4.99	F	65				0.59		
				M	110				0.62		
			5-5.99	F	83				0.59		
				M	138				0.62		
	Cash crop zone		.5-6	B	91		20.9	69.2	0.53**		
	Cropping zone				477		15.1	55.6	0.65**		
	Ensete zone				36		16.6	77.8	0.50**		
	Pastoral zone				138		18.1	62.3	0.62**		
	Shoa Region				344				1.00**		
	Melkaye village (rural) - Hararge Region	1990s	0-12.5		80		30.2	88.2	0.46**		1072
GAMBIA	Keneba, Manduar & Kanton	01/88	2-5.99	B	157	A			0.41	0.021	1050
		04/88			157				0.69	0.021	
		08/88			157				0.78	0.029	
GHANA	VAST Morbidity Study - Kassena Nankana	6/90-8/91	.5-4.99	B	1455	A	15.8	73.4			1064
	VAST Survival Study - Kassena Nankana				21 906		14.4	56.9			
	Upper East - Kassena Nankana	1991	0-6		607	Z	14.0	54.9			7016
			0-0.5		9		11.1	33.3			
			0.5-1		54		14.8	53.7			
			1-2		118		9.3	49.1			
			2-3		113		20.4	58.5			
			3-4		11		17.1	57.3			

* Laboratory Assessment: 'A' = HPLC, 'B' = Spectophotometry, 'C' = 'Colorimetry, 'D' = Flourescence, 'Z' = Not Specified
** Median

Indicators of Vitamin A Deficiency - Serum Vitamin A											
Country	Geographic Area	Survey year	Age group	Sex	Sample size	Vitamin A Levels (umol/l)					Ref. no.
						*	< 0.35	< 0.70	Mean	S.D.	
			4-5		122		13.9	52.2			
			5-6		74		6.8	59.5			
	Kintampo District	04/1994	1-4.99		99	A		51.0			1058
	- northern region				50		8.0	64.0	0.64		
	- southern region				49		6.0	37.0	0.80		
Lesotho	National Micronutrient Survey	1993	2-6	B	127	Z	13.4	78.0	0.55	0.20	1055
Mali	South Mali - rainy season	07-08/78	0-5.99	B	16	C	12.5	75.0	0.58	0.26	7012
			6-14		119		0.0	57.9	0.67	0.23	
			adults		253		2.7	30.0	0.85	0.28	
			pregnant	F	60		1.6	38.3	0.77	0.23	
	- dry season	03-04/79	0-5.99	B	57		14.0	71.0	0.58	0.23	
			6-14		197		0.5	45.6	0.74	0.25	
			adults		388		3.3	22.6	0.96	0.36	
			pregnant	F	92		4.3	34.7	0.85	0.36	
	Kolokani (Northwest Bamako)	1990	2-10	B	152	A	15.1		0.53	0.03	1030
Mauritania	Hodh-el Gharbi: Kerkerat	1987	1-15	B	81	Z	10.0	60.6			1069
	Hodh-el Gharbi: Limberha				125		0.0	22.5			7016
Namibia	17 villages	1992	2-6	B	290	A	3.1	20.4			1037
									0.89	0.28	1068
Niger	Refugee camps	1975?	< 5	B	16	A	12.5	37.5			1067
	- nomads										
			> 5		56		16.1	39.3			
			all		72		15.3	38.9			
	- sedentary		< 5		5		20.0	60.0			
			> 5		42		16.6	92.8			
			all		86		36.0	87.2			
			N.S.		39		58.9	84.6			
	Refugee camps			F	27		18.5	63.0			
	- nomads - pregnant or lactating										
	- sedentary - pregnant or lactating				14		50.0	71.4			
	- nomads and sedentary- pregnant or lactating				41		29.3	65.8			
	- total			B	199		27.1	65.3			
Nigeria	Cross River State	1983?	birth	F	62	Z			0.85	0.08	1043
				M	50				0.93	0.22	
			1.5 weeks	F	62				0.94	0.07	
				M	50				0.99	0.13	
			0.25	F	60				1.14	0.34	
				M	40				1.29	0.15	
			0.6	F	56				1.26	0.23	
				M	44				1.33	0.15	
			1	F	56				1.47	0.50	
				M	44				1.54	0.37	
			children	F	112				2.35	0.49	
	National - South	1994	0-5.99	B	941				0.72		1061
Senegal	Casmance - South Senegal	11-12/79	0-5.99	B	51	C	5.8	45.0	0.70	0.25	7012
			6-14		231		1.7	41.5	0.79	0.27	
			adults		620		0.6	10.6	1.09	0.39	
			pregnant	F	113		0.0	9.7	1.04	0.32	
	Diourbal, Fatick & Kaolack	04/88	0-4.99	B	92	A			0.45	0.04	1023
	- normal by ICT										
	- M+ by ICT				23				0.43	0.09	
	- M- by ICT				45				0.46	0.06	
	- deficient by ICT				13				0.31	0.08	
	Malicounda	02-03/90	2-6	Z	221		20.9		0.52	0.03	1053
	Gadiack & Diop N'doffene	4/1989	2-7	B	185		40.0		0.43		1071
		6/1989			185		11.4		0.57		
	Louga - Linguere Department	7/1991	2-4.00		271		7.4	71.5	0.61	0.22	1074
South Africa	Bester Farm	11/91	3-6	B	N.S.	B					
	- CIC normal								0.77	0.25	1044
	- CIC borderline abnormal				N.S.				0.71	0.20	
	- urban shack settlement				169		5.0	49.0	0.73	0.26	
United Republic of Tanzania	Iringa	1982-85	children	B	23	Z	0.0	13.0			1028
	Tabora				64		1.5	45.3			

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** Median

Country	Geographic Area	Survey year	Age group	Sex	Sample size	INDICATORS OF VITAMIN A DEFICIENCY - SERUM VITAMIN A					Ref. no.
						Vitamin A Levels (umol/l)					
						*	< 0.35	< 0.70	Mean	S.D.	
	Dar-es-Salaam				34				0.40	0.23	
	- children with measles										
	- children with no measles				13				0.89	0.21	
	Lusu Ward: Nzega District - children without xerophthalmia	1985			551	A			0.69	0.05	1027
ZAMBIA	Luapula	1985	0-5.99	B	N.S.	Z	16.5				7001
	Ndola:	1989	6-12		353		0.34	13.6			7016
	Kabwata				90		0.0	27.0			
	Kanshensi				98		0.0	3.1			
	Lumano				18		0.0	33.3			
	Masala				90		1.1	7.8			
	Chibolele				110		0.0	20.0			
REGION OF THE AMERICAS											
BELIZE	National	1990	0-4.99	B	N.S.	A		10.0			7007
	National	1990s ?	2-8		494		0.2	6.1	1.03		2021
BOLIVIA	National	1991	1-5	B	891	A	0.1	11.3			2016
	Altiplano - urban				N.S.			7.0			
	- concentrated rural							19.3			
	- poor area - rural		children					17.6			7002
	- rural dispersed		1-5					13.7			2016
	Llano - urban							8.4			
	- concentrated rural							16.5			
	- rural dispersed							11.9			
	- poor area		children					12.9			7002
	Valle - urban		1-5					8.2			2016
	- concentrated rural							9.3			
	- rural dispersed							3.9			
	La Paz		0-4.99				1.2	9.0			7007
BRAZIL	National (migrants)	1972	N.S.	B	1081	Z	8.7	25.3			2007
	Northeast				255		5.9	26.3			
	South				79		7.6	11.4			
	Southeast				671		9.8	26.3			
	West				73		9.6	27.4			
	Northeast		0-6		N.S.		4.9	22.7			7010
	Gameleira and Agua Preta	1973 ?	pregnant	F	165		0.0	2.5			2007
	Northeast	1981	0-6	B	N.S.		6.4	23.1			7010
		1982					1.5	14.7			
	Paraiba	1982	0-4		328		2.1	15.8			2002
	- litoral				155		1.9	16.7			
	- semi-arid				107		3.7	20.5			
	- transitional				66		0.0	6.1			
	Northeast	1983	0-6		N.S.		3.3	17.5			7010
		1984	1-7					13.2			
	Sao Paolo		0-4			B	3.6	30.2			2008
	- urban slum study										
	- baseline		2-8		276		1.8	48.8			
	- after oral supplementation				99		2.0	86.8			
	South - before supplementation				97		1.0	89.6			
	- 20 days after suppl.				97		0.0	40.2			
	Poor areas - 3 periurban communities				182		2.7	73.6			
	South	1986	2-8		N.S.	Z	1.8	48.8			7010
	Bahia - semi arid	1989	0-6		563		15.3	54.7			2032
CHILE	National	1960	0-15	B	N.S.	Z	3.1	21.6			7010
COLOMBIA	National	1960	0-15	B	N.S.	Z	1.2	16.0			7010
		1977	0-4.99				0.0	24.1			
			5-9				0.0	28.8			
	Northern Coast		N.S.					41.1			7020
COSTA RICA	National	1979	0-5	B	N.S.	Z	0.0	2.3			7010
		1981					0.0	1.8			
DOMINICAN REPUBLIC	National	1969	0-15	B	N.S.	Z		9.0			7009
	Southwest	1991	1-5		505		4.2	19.6			
			1-2		104		2.9	15.4			
			2-3		101		5.9	24.7			
			3-4		94		5.3	20.2			
			4-5		115		3.5	18.3			
			5-6		91		3.3	19.8			

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** Median

						Indicators of Vitamin A Deficiency - Serum Vitamin A					
Country	Geographic Area	Survey year	Age group	Sex	Sample size	Vitamin A Levels (umol/l)					Ref. no.
						*	< 0.35	< 0.70	Mean	S.D.	
	- rural				N.S.		5.2	21.3			
	- urban						3.3	24.7			
Ecuador	National	1986	0-4.99	B	1570	Z	0.2	14.1			7010
	- rural							16.4			
	- urban							11.9			
	- Azuay	1993	1-4.99		345	A		25.6			2026
	- Chimborazo				255			17.7			
	- Cotopaxi				183			9.6			
	- Esmeraldas				220			18.1			
	- Manabi				559			14.8			
	- rural				573			21.9			
	- urban				386			12.9			
El Salvador	National - INCAP data	1976	1-6	B	N.S.	Z		33.3			7011
	National	1988	0-4					36.0			7007
	- rural							40.8			
	- urban							32.7			
	4 rural communities - Ahuashapan	1980s ?	0-4		259			36.0			2015
	Huatales				65		6.0	41.0			
	Magueyes				64		8.0	36.0			
	Palo Pique				64		11.0	58.0			
	Roble				66		3.0	26.0			
Guatemala	National	1970	0-4	B	N.S.	Z		26.2			7010
	Guatamalan children	10-11/75	0-4		543	B	3.3	21.5	1.02	0.36	2010
	- baseline sugar fort.										
	-1 year sugar fort. trial	10-11/76			644		0.3	5.1			
	National	1976			0-5	Z		33.0			7010
	Guatamalan children - 2 year sugar fortification trial	10-11/77	1-5		721	B	0.3	9.2			2010
	National - rural	1988	1-4		N.S.	Z	3.2	21.6			7009
		1989	0-5					26.0			7010
	Western - HOPE/INCAP	1991	<6		3250			20.0			7021
	- high altitude				N.S.			14.0			
	- low altitude							37.0			
Honduras	National	1987	0-4	B	N.S.	Z		20.0			7020
Mexico	Yucatan	1984	N.S.	B	N.S.	Z		25.9			7020
	Hermosilla	1990	2-7		N.S.			32.0			7009
Nicaragua	USAID - preliminary results	1993	1-4.99	B	N.S.			7.9	31.3		7023
Panama	National - 4 regions	1992	1-4.99	B	1103	B	0.0	6.0	1.31		2027
	- indigenous				106		2.0	13.0	1.11	0.41	2033
	- non-indigenous				976		0.0	5.0	1.33	0.42	
Peru	Lima hospital	1989	.5-1.5	B	72	B			0.51	0.46	2034
	- children with diarrhea										
	- healthy control				65				1.00	0.32	
	Piura- rural	1992	0-6		300	Z		32.8			7020
	Puno- rural				N.S.			14.1			
United States of America	N-Hanes I	1971-74	3-5.99	B	689	A		2.0			2011
				M	725			2.8			
			6-11.99	F	927			0.5			
				M	930			0.5			
	NHanes I	1971-74	4-5	F	485				1.27		2014
				M	501				1.28		
	- black			F	127				1.13		
				M	118				1.12		
	- white			F	354				1.27		
				M	381				1.31		
	National	1976-80		F	471	Z			1.16		
				M	493				1.13		
	NHanes - Mexican Americans			F	100	A			0.96		
				M	500				1.03		
	NHanes II	1976-80	4-5	F	418				1.10		
				M	500				1.16		
	- black			F	74				1.06		
				M	69				1.04		
	- white			F	335				1.10		
				M	413				1.18		
	New York City - Pb screen healthy			B	75				1.26		

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** Median

Country	Geographic Area	Survey year	Age group	Sex	Sample size	INDICATORS OF VITAMIN A DEFICIENCY - SERUM VITAMIN A: Vitamin A Levels (umol/l) *	< 0.35	< 0.70	Mean	S.D.	Ref. no.
	- measles and convalescent				111				1.23		
	Puerto Ricans in NYC		12-17	M	1026			0.0			2011
	Mex-American SW, Cuban-American			F	1009			0.3			
	NHanes II	1976-80	3-5.99	F	589			6.1			
				M	702			3.4			
			6-11	F	604			2.3			
				M	613			2.2			
	Mexican Americans in SW	1982-83	4-5.99	B	234			4.6	1.00		
				M	134			3.8			
				F	100			5.8			
			6-11.99	B	1028			2.7	1.11		
				F	521			2.9			
				M	507			2.4			
			12-17	B	982			0.1			
				F	496			0.2			
				M	486			0.0			
	Non-Hispanic		4-5.99	B	142			5.7	1.04		
	- blacks										
	- whites				654			2.5	1.15		
	- blacks		6-11.99		179			2.2	1.19		
	- whites				926			1.7	1.19		
SOUTH-EAST ASIA REGION											
BHUTAN	National	1985	0-4	B	134	Z	14.0				7008
	National - pregnant women		pregnant	F	149		13.0				
INDIA	Coimbatore district	N.S.	N.S.	B	20	Z			0.42	0.07	5058
	- control - initial										
	- control - 3 months				20				0.42	0.07	
	- control - 6 months				20				0.43	0.06	
	- control - 9 months				20				0.63	0.08	
	- control - final				20				0.64	0.08	
	- Papaya fed - initial				20				0.40	0.11	
	- Papaya-fed - 3 months				20				0.86	0.05	
	- Papaya-fed - 6 months				20				1.20	0.06	
	- Papaya-fed - 9 months				20				1.36	0.16	
	- Papaya-fed- final				20				1.64	0.18	
	- Amaranth-fed-initial				20				0.43	0.10	
	-Amaranth-fed -3 months				20				0.89	0.05	
	-Amaranth-fed-6 months				20				1.21	0.06	
	- Amaranth-fed-9 months				20				1.49	0.06	
	- Amaranth-fed -final				20				1.50	0.07	
	- Carrot-fed - initial				20				0.41	0.07	
	- Carrot-fed - 3 months				20				0.90	0.05	
	- Carrot-fed - 6 months				20				1.25	0.06	
	- Carrot-fed - 9 months				20				1.58	0.10	
	- Carrot-fed - final				20				1.84	0.07	
	Tamil Nadu - drought prone	1989	.5-4.99		280		21.4	37.5			5035
	Slum area in Gorakhpur		0-5		6	C		100.0	0.44	0.05	5036
	- nightblind children										
	- X1A +				14		21.4	78.6	0.44	0.07	
	- X1B +				8		25.0	75.0	0.42	0.09	
INDONESIA	Nine regencies	1975-76		F	305	Z	17.0	51.0			5050
	- lactating				61		23.0	66.0			
	- pregnant			B	131		13.0	58.0			
	- representative				268		9.0	47.0			
	West Java (Putkakarta)	1978									7008
	Bandung - Bitot's spots	02-08/83	3.5-4.5		4	A			0.15	0.07	5060
	- Bitot's spots 10days				4				0.70	0.20	
	- Bitot's spots 21 days				4				0.42	0.12	
	- corneal xerosis				5				0.27	0.18	
	- corneal xerosis 10 day				5				1.12	0.73	
	- corneal xerosis 21 day				5				0.84	0.45	
	- nightblind				6				0.45	0.25	
	- nightblind 10 days				6				0.52	0.29	
	- nightblind 21 days				6				0.52	0.21	
	- reduced growth				5				0.66	0.24	
	- reduced growth 10 days				5				0.66	0.24	
	- reduced growth 21 days				5				0.63	0.25	
	- satis. growth 10 days				5				0.59	0.25	
	- satis. growth 21 days				5				0.38	0.13	
	- satisfactory growth				5				0.45	0.23	
	South Sulawesi	1988	0-5		N.S.	Z	8.9				7005
	West Java						5.9				

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** Median

						Indicators of Vitamin A Deficiency - Serum Vitamin A					
Country	Geographic Area	Survey year	Age group	Sex	Sample size	Vitamin A Levels (umol/l)					Ref. no.
						*	< 0.35	< 0.70	Mean	S.D.	
	West Kalimantan						15.6				
	Irian Jaya	1991			484		13.6	68.8	0.60	0.28	
	Maluku				508		12.6	69.3	0.64	0.39	
	Nasa Tenggara Timur				536		9.1	58.0	0.71	0.37	
	Timor Timur				341		14.9	86.6	0.73	0.38	
	West Java (Bogor)		N.S.		257		1.2	32.7			7008
	Rural Javanese community		0.5-0.99		96		10.0	69.0	0.59	0.18	5071
			1-1.99		173		6.0	63.0	0.66	0.21	
			2-2.99		191		5.0	50.0	0.69	0.21	
			3-3.99		208		7.0	58.0	0.65	0.21	
			4-4.99		20		0.0	65.0	0.67	0.21	
	Cibungbulang Subdistrict : Bogor	11/12-92	15-40		73	A		30.1	0.98	0.44	5083
	West Java: Bogor - lactating women after oral dosing	1994	17-37	F	64				0.99	0.35	
	West Java Bogor - non-pregnant control group after oral dosing		29-41		14				1.47	0.31	
Myanmar	Kyaukpadaung	1987-89	2-14	B	480	Z	8.9	60.0			5063
			2-5.99		185		16.1	76.1			
			6-9.99		137		11.1	49.5			
			10-14		158		1.3	53.6			
	Hinthada		2-14		581		7.9	18.2			
			2-5.99		199.		11.0	22.9			
			6-9.99		196		5.4	17.6			
			10-14		186		7.4	14.1			
	Monywa		2-14		424		4.7	15.8			
			2-5.99		114.		2.3	19.5			
			6-9.99		223		7.6	18.3			
			10-14		87		2.5	7.5			
	Taunggyi		2-14		377		0.0	6.7			
			2-5.99		144.		0.0	10.8			
			6-9.99		131		0.0	3.5			
			10-14		102		0.0	4.9			
Sri Lanka	All children w/+ eye findings	10/75-3/76	.5-5.99	B	29	Z	7.0	21.0			5054
	All children w/- eye findings				350		0.0	5.0			
	subsample - rural children				346			5.0			
			4-6		139			6.0			
	Ratnapura and Kandy		.5-6		178				1.12		
	- rural serum sample										
	- wasted only				16				1.20		
	- rural serum sample		4-6		63				1.17		
	- village serum sample		N.S.		141				1.14		
	- estate serum sample				37				1.06		
	- rural-wasted sample		4-6		5				1.13		
	- village-wasted sample		N.S.		10				1.29		
	- estate-wasted sample				5				1.00		
	Colombo - serum normal		4-6		137				1.35		
	- special children				143			0.0			
	- rural-wasted				2				1.19		
Thailand	Ubon	1974-78	0-4	B	143	Z	17.0	87.0	0.53	0.03	5082
			schoolage		67		22.0	73.0	0.56	0.04	
			children	F	43		2.0	44.0	0.81	0.04	
	Ramathibodi hospital	1984	N.S.	B	15		7.0		0.84	0.10	5072
	- control group										
	- with measles				25		32.0		0.42	0.03	
	Sakon Nakhon		1-2.99		127		23.6	81.9			5029
	- rural										
				F	62		27.4	83.9	0.54	0.22	
				M	65		20.0	80.0	0.52	0.22	
			3-6	B	410		9.3	41.5			
				F	218		6.9	39.5	0.81	0.33	
				M	192		12.0	43.8	0.75	0.26	
			6-8.99	B	315		4.5	42.3			
				F	162		5.6	37.7	0.79	0.30	
				M	153		3.3	46.8	0.74	0.25	
	- urban		3-6	B	100		0.0	21.9			
			3-6	M	48		0.0	20.8	0.90	0.23	
			3-6	F	52		0.0	23.1	0.87	0.22	
	Sakon Nakhon	1986	3-9	B	50	A			0.60		
	- baseline (supplemented)										
	- control post intervention				45				0.54		
	- supp. post intervention				50				0.75		
	North and Northeast Province	1990	2-6		996		0.6				7005

* Laboratory Assessment: 'A' = HPLC, 'B' = Spectophotometry, 'C' = 'Colorimetry, 'D' = Flourescence, 'Z' = Not Specified
** Median

						Indicators of Vitamin A Deficiency - Serum Vitamin A					
Country	Geographic Area	Survey year	Age group	Sex	Sample size	Vitamin A Levels (umol/l) *	< 0.35	< 0.70	Mean	S.D.	Ref. no.
	- dry season	02-03/90			485		0.6	14.9	1.02	0.34	5070
	Maehongson				43			39.6			
					15				0.85	0.22	
	Mukdaharn				49			4.1			
					21				1.10	0.35	
	Nan				43			6.3			
					26				1.05	0.23	
	Payao				100			19.0			
					53				0.96	0.26	
	Pisanuloke				59			2.0			
					14				1.31	0.35	
	Sakolnakorn				98			24.5			
					49				0.94	0.46	
	Surin				48			10.4			
					11				0.93	0.25	
	Khon kaen	09-10/90			43			4.7			
					24				1.04	0.27	
	Maehongson				53			3.8			
					15				1.62	0.25	
	Mukdaharn				48			2.1			
					21				1.89	0.81	
	Nan				54			24.1			
					26				1.07	0.23	
	Payao				53				1.14	0.35	
					101			10.9			
	Pisanuloke				14				1.61	0.35	
					49			2.0			
	Sakolnakorn				98			5.0			
					49				1.27	0.42	
	Surin				56			3.9			
					11				1.26	0.35	
	North and Northeast Thailand - Totals				499		0.6	7.2	1.30	0.54	
	National Data	1991	6-11		N.S.	Z	3.0	39.2			5079
EUROPEAN REGION											
FRANCE	Tours	3/85-1/86	1-16	B	392	A			1.47	0.42	4005
				F	185				1.46	0.37	
				M	207				1.50	0.46	
			1-3	B	10				0.96	0.24	
			3-6		13				1.01	0.23	
			6-9		112				1.33	0.33	
			9-12		104				1.41	0.33	
			12-14		50				1.53	0.34	
			14-16		97				1.81	0.43	
ISRAEL	Arab children- low SES - E. Jerusalem	1970s ?	5.5	F	24	C	0.0	83.3	0.58	0.11	4001
				M	23		8.7	86.9	0.60	0.22	
ROMANIA	Orphanage	1970s	N.S.	B	117	Z			0.74	0.33	4003
TURKEY	Marmara, Central and East Anatolia	4/85-5/86	7-17	B	960	Z			1.18	0.46	4002
			7	F	60				1.24	0.55	
				M					1.29	0.58	
			8	F					1.42	0.77	
				M					1.18	0.61	
			9	F					1.32	0.48	
				M					1.34	0.76	
			10	F					1.23	0.56	
				M					1.28	0.55	
			11	F					1.42	0.70	
				M					1.32	0.73	
			12	F	30				1.34	0.75	
				M					1.90	0.35	
			13	F					1.19	0.47	
				M					1.57	1.35	
			14	F					1.26	0.73	
				M					1.26	0.51	
			15	F					1.29	0.54	
				M					1.27	0.52	
			16	F					1.22	0.37	
				M					1.07	0.36	

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** Median

						Indicators of Vitamin A Deficiency - Serum Vitamin A					
Country	Geographic Area	Survey year	Age group	Sex	Sample size	Vitamin A Levels (umol/l)					Ref. no.
						*	< 0.35	< 0.70	Mean	S.D.	
			17	F					1.37	0.66	
				M					1.24	0.53	
	Small Towns		7-17	B	150				1.34	0.62	
	City				150				1.18	0.46	
	Villages				300				1.36	0.67	
	Ankara - sick control group	1994	children		14			42.9			4004
	- measles group				21			90.5			
	- health group				21			9.5			
Uzbekistan	Karakalpakistan - Muynak	5-6/1993	all	B	851	Z	16.4	48.9			4006
EASTERN MEDITTERANEAN REGION											
Djibouti	Djibouti - rural	1988	4-10	B	114	A	0.9	12.3			3013
				F	N.S.		0.0	14.3			3028
				M			1.6	11.1			
	- urban			B	83		2.4	21.7			3013
				F	N.S.		5.1	23.0			3028
				M			0.0	22.0			
Iran (Islamic Republic of)	4 provinces	N.S.	0-4.99	B	N.S.	Z		9.0			3016
			6-12					6.4			
			13-17					2.7			
	Kohguiluyeh and Boyerahmad		7-17				0.0				
	Tehran - goitre endemic area		children	F				0.0			
Oman	National	1995	.5-6	B	759	A	2.1	20.8	0.94	0.34	3029
				F	378		2.6	18.7	0.95	0.36	
				M	381		1.6	22.9	0.93	0.32	
			.58	B	219		2.3	21.0	0.95	0.34	
			1.5		219		1.8	22.8	0.94	0.33	
			3		103		4.9	20.4	0.95	0.37	
			6+		218		0.9	18.8	0.93	0.33	
	Muscat		.5-6		191		6.3	39.8	0.76	0.30	
	Dhofar				73		2.8	15.3	0.99	0.33	
	Dhakiliya				121		0.0	1.7	1.10	0.23	
	N. Sharqiya				60		0.0	1.7	1.25	0.34	
	S. Sharqiya				69		0.0	4.3	1.09	0.28	
	N. Batinah				130		1.5	26.9	0.84	0.33	
	S. Batinah				64		0.0	20.4	0.98	0.37	
	Dhahira				61		0.0	26.2	0.83	0.24	
Pakistan	Karachi	N.S.	0-14.99	F	N.S.	Z	?	16.0			3014
				M			?	20.0			
		2-3/90	.5-4.99	B	532	A	2.3	48.3			3027
	National micronutrient survey	1976-77	all		6738		4.5	13.0			3007
				F			4.3	14.8			
				M			4.7	12.7			
			children	F	N.S.		0.0	2.1			
			pregnant		N.S.		5.6	10.7			
	Azambasti	1988-89	.5-5.00	B	154		?	57.0			3014
	Chenesar-Goth				159		?	70.0			
	Esanagri				265		?	29.0			
Saudi Arabia	Riyadh	N.S.	N. S.	B	N.S.	Z	1.1	9.9			3009
Yemen	Tihama Region - rural	6-7/92	1-5.99	B	319	Z	7.2	62.4			3025
			1-1.99		60		5.0	65.0			
			2-2.99		58		13.8	62.1			
			3-3.99		71		11.3	66.2			
			4-4.99		56		3.6	60.7			
			5-5.99		74		2.7	58.1			
WESTERN PACIFIC REGION											
China	National - Beijing (urban)	1982	0-2	B	N.S.	Z		17.0			6018
	Rural China	N.S.	.5-2					20.0			
Malaysia	Peninsular Malaysia	1964	10-14	F	70	Z	5.7	22.8	0.97	0.05	6006
				M	79		2.5	24.0	1.06	0.06	
			15-44	F	111		2.7	9.0	1.28	0.05	
				M	75		0.0	1.3	1.50	0.05	
			5-9	F	59		8.5	30.5	0.97	0.07	
				M	57		0.0	24.6	0.98	0.06	

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** Median

						Indicators of Vitamin A Deficiency - Serum Vitamin A					
Country	Geographic Area	Survey year	Age group	Sex	Sample size	Vitamin A Levels (umol/l)					Ref. no.
						*	< 0.35	< 0.70	Mean	S.D.	
			>45	F	24		4.2	25.0	1.21	0.13	
				M	22		0.0	4.5	1.41	0.12	
			children	F	25		4.0	16.0	1.02	0.07	
			pregnant		8		0.0	12.5	1.15	0.13	
	Sungai Choh	1977	0-4	B	22			32.0	0.84	0.21	
			school		80			27.0	0.91	0.39	
	Ulu Rening		0-4		38			32.0	0.88	0.28	
			school		69			16.0	1.12	0.39	
	Rural community - peninsular Malaysia	1984	0-4		25			12.0	1.12	0.33	
			12-17.99	F	61			3.0	1.93	0.67	
				M	32			16.0	1.54	0.77	
			18-45	F	353			12.0	1.65	0.84	
				M	152			7.0	1.61	0.67	
			>46	F	14			7.0	1.47	0.60	
				M	14			0.0	1.89	1.16	
			school	B	40			10.0	1.16	0.44	
Micronesia (Federated States of)	National - Chuuk	12/88-5/89	3-6.99	B	254	Z	15.0	64.0	0.60		6017
Papua New Guinea	East Sepik	N.S.	.5-15	B	237	Z	50.0	91.0	0.41	0.20	6021
			5-5.99		74		2.7	58.1			
			.5-6		N.S.				0.31	0.02	
			6-15						0.44	0.02	
Philippines	Cebu -12 poor areas	1973-74	1-16	B	1700	Z	17.0	47.0			6012
	- pre-intervention non MSG group				727				0.68		
	- post-intervention non MSG group				727				0.55		
	- pre-intervention MSG group				387				0.74	0.43	
	- post-intervention MSG group				387				1.00	0.52	
	Cebu Island				1715		17.0	57.0			6002
	- rural-coastal				N.S.		20.0	62.0			
	- urban- squatter						17.0	54.0			
	- urban-barrio						15.0	59.0			
	Northern Mindanao	1986	.5-.99					20.0			7003
			1-6					15.7			
			children	F				10.0			
			pregnant					7.5			
	Southern Tagalog		0.5-.99	B				19.5			
			1-5.99					10.4			
			children	F				1.4			
			pregnant					7.3			
	Western Visayas		0.5-.99	B				33.3			
			1-5.99					10.9			
			children	F				21.0			
			pregnant					24.1			
	National	1987	0-5.99	B	3389		2.6				6022

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** Median

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Global Prevalence of Vitamin A Deficiency

Annexes

Listing of Countries According To WHO and UNICEF Regions

WHO regions

Africa	Americas	South-East Asia	Europe	Eastern Mediterranean	Western Pacific
Algeria	Antigua & Barbuda	Bangaldesh	Albania	Afghanistan	Australia
Angola	Argentina	Bhutan	Armenia	Bahrain	Brunei Darussalam
Benin	Bahamas	Democratic People's Republic of Korea	Austria	Cyprus	Cambodia
Botswana	Barbados	India	Azerbaijan	Djibouti	China
Burkina Faso	Belize	Indonesia	Belarus	Egypt	Cook Islands
Burundi	Bolivia	Maldives	Belgium	Iran (Islamic Rep. of)	Fiji
Cameroon	Brazil	Mongolia	Bosnia & Herzegovina	Iraq	Japan
Cape Verde	Canada	Myanmar	Bulgaria	Jordan	Kiribati
Central African Republic	Chile	Nepal	Croatia	Kuwait	Lao P.D.R.
Chad	Colombia	Sri Lanka	Czech Republic	Lebanon	Malaysia
Comoros	Costa Rica	Thailand	Denmark	Libyan Arab Jamahiriya	Marshall Islands
Congo	Cuba		Estonia	Morocco	Micronesia (Fed. States of)
Côte d'Ivoire	Dominica		Finland	Oman	Nauru
Equatorial Guinea	Dominican Repub.		France	Pakistan	New Zealand
Eritrea	Ecuador		Georgia	Qatar	Niue
Ethiopia	El Salvador		Germany	Saudi Arabia	Papua New Guinea
Gabon	Grenada		Greece	Somalia	Philippines
Gambia	Guatemala		Hungary	Sudan	Republic of Korea
Ghana	Guyana		Iceland	Syrian Arab Rep.	Samoa
Guinea	Haiti		Ireland	Tunisia	Singapore
Guinea-Bissau	Honduras		Israel	United Arab Emirates	Solomon Islands
Kenya	Jamaica		Italy	Yemen	Tokelau
Lesotho	Mexico		Kazakhastan		Tonga
Liberia	Nicaragua		Kyrgyzstan		Tuvalu
Madagascar	Panama		Latvia		Vanuatu
Malawi	Paraguay		Lithuania		Viet Nam
Mali	Peru		Luxembourg		
Mauritania	Puerto Rico		Malta		
Mauritius	St. Kitts & Nevis		Monaco		
Mozambique	St. Lucia		Netherlands		
Namibia	St. Vincent & the Grenadines		Norway		
Niger	Suriname		Poland		
Nigeria	Trinidad & Tobago		Portugal		
Rwanda	United States of America		Republic of Moldova		
Sao Tome & Principe	Uruguay		Romania		
Senegal	Venezuela		Russian Federation		
Seychelles			San Marino		
Sierra Leone			Slovakia		
South Africa			Slovenia		
Swaziland			Spain		
Togo			Sweden		
Uganda			Switzerland		
United Republic of Tanzania			Tajikistan		
Zaire			The former Yugoslav Rep. of Macedonia		
Zambia			Turkey		
Zimbabwe			Turkmenistan		
			Ukraine		
			U.K. of Great Britain & Northern Ireland		
			Uzbekistan		
			Yugoslavia		

UNICEF REGIONS

Eastern and Southern Africa	Central and West Africa	Middle East and North Africa	East Asia and the Pacific	Americas and the Caribbean	Developed/ Industrialized Countries
Angola	Benin	Algeria	Brunei Darussalam	Antigua & Barbuda	Albania
Botswana	Burkina Faso	Bahrain	Cambodia	Argentina	Armenia
Burundi	Cameroon	Cyprus	China	Bahamas	Australia
Comores	Cape Verde	Djibouti	Cook Islands	Barbados	Austria
Ethiopia	Central African Rep.	Egypt	Fiji	Belize	Azerbaijan
Kenya	Chad	Iran, Islamic Rep.	Indonesia	Bolivia	Belarus
Lesotho	Congo	Iraq	Kiribati	Brazil	Belgium
Madagascar	Côte D'Ivoire	Jordan	Korea, Dem.	Chile	Bosnia/Herzegovina
Malawi	Equatorial Guinea	Kuwait	Korea, Rep. of	Colombia	Bulgaria
Mauritius	Gabon	Lebanon	Lao P.D.R.	Costa Rica	Canada
Mozambique	Gambia	Libya	Malaysia	Cuba	Croatia
Namibia	Ghana	Morocco	Marshall Islands	Dominica	Czech Republic
Rwanda	Guinea	Oman	Micronesia	Dominican Republic	Denmark
Seychelles	Guinea-Bissau	Qatar	Mongolia	Ecuador	Estonia
Somalia	Liberia	Saudi Arabia	Myanmar	El Salvador	Finland
South Africa	Mali	Sudan	Papua New Guinea	Granada	France
Swaziland	Mauritania	Syria	Philippines	Guatemala	Georgia
Tanzania, UR	Niger	Tunisia	Samoa	Guyana	Germany
Uganda	Nigeria	Turkey	Singapore	Haiti	Greece
Zambia	Sao Tome & Principe	United Arab Emirates	Solomon Islands	Honduras	Hungary
Zimbabwe	Senegal	Yemen	Thailand	Jamaica	Iceland
	Sierra Leone		Tonga	Mexico	Israel
	Togo		Vanuatu	Nicaragua	Italy
	Zaire		Viet Nam	Panama	Japan
				Paraguay	Kazakhstan
			South Asia	Peru	Kyrgyzstan
			Afghanistan	St. Christ. & Nevis	Latvia
			Bangladesh	St. Lucia	Lithuania
			Bhutan	St. Vincent & Gren.	Luxembourg
			India	Suriname	Malta
			Maldives	Trinidad & Tobago	Moldova
			Nepal	Uruguay	Netherlands
			Pakistan	Venezuela	New Zealand
			Sri Lanka		Norway
					Poland
					Portugal
					Romania
					Russian Federation
					San Marino
					Slovak
					Slovenia
					Spain
					Sweden
					Switzerland
					Tajikistan
					Turkmenistan
					Ukraine
					United Kingdom
					USA
					Uzbekistan
					Yugoslavia, Former

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Vitamin A deficiency (VAD) is the single most important cause of childhood blindness in developing countries. It also contributes significantly, even at subclinical levels, to morbidity and mortality from common childhood infections. VAD is the result of two primary factors: persistent inadequate intake of vitamin A that is frequently exacerbated by others dietary circumstances, and a high frequency of infections. An estimated 2.8 million preschool-age children are at risk of blindness from VAD, and the health and survival of 251 million others are seriously compromised.

Heightened awareness of the role of vitamin A in human health has led to an international effort to eliminate vitamin A deficiency and its consequences as a public health problem by the year 2000. This is among the important end-of-decade micronutrient goals endorsed by the World Summit for Children (1990), the International Conference on Nutrition (1992), and the World Health Assembly (1993).

This document provides a baseline which national and international health authorities can use to track progress achieved towards the virtual elimination of VAD as a public health problem. It is divided into four sections. The first describes the nature of VAD and reviews the epidemiological issues involved in measuring and interpreting VAD prevalence studies. The second section presents summary tables of the most recent prevalence data, by country and WHO region. The third section presents more detailed sub-national prevalence data by WHO region. The fourth section provides complete bibliographic information for all data sources presented.